MOTOROLA
Network Solutions Sector

iDEN™

integrated Site Controller

SYSTEM MANUAL

FCC INTERFERENCE WARNING

The FCC requires that manuals pertaining to Class A computing devices must contain warnings about possible interference with local residential radio and TV reception. This warning reads as follows:

> Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

INDUSTRY OF CANADA NOTICE OF COMPLIANCE

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.
Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.
"ATTENTION – BATTERY DISPOSAL: The Site Controller Motherboard contains an integral lithium battery. Refer to local regulatory requirements for proper disposal"

COMMERCIAL WARRANTY (STANDARD)

Motorola radio communications products (the "Product") is warranted to be free from defects in material and workmanship for a period of ONE (1) YEAR (except for crystals and channel elements which are warranted for a period of ten (10) years) from the date of shipment. Parts including crystals and channel elements, will be replaced free of charge for the full warranty period but the labor to replace defective parts will only be provided for One Hundred-Twenty (120) days from the date of shipment. Thereafter purchaser must pay for the labor involved in repairing the Product or replacing the parts at the prevailing rates together with any transportation charges to or from the place where warranty service is provided. This express warranty is extended by Motorola, 1301 E. Algonquin Road, Schaumburg, Illinois 60196 to the original end use purchaser only, and only to those purchasing for purpose of leasing or solely for commercial, industrial, or governmental use.

THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED WHICH ARE SPECIFICALLY EXCLUDED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL MOTOROLA BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

In the event of a defect, malfunction or failure to conform to specifications established by Motorola, or if appropriate to specifications accepted by Motorola in writing, during the period shown, Motorola, at its option, will either repair or replace the product or refund the purchase price thereof. Repair at Motorola's option, may include the replacement of parts or boards with functionally equivalent reconditioned or new parts or boards. Replaced parts or boards are warranted for the balance of the original applicable warranty period. All replaced parts or product shall become the property of Motorola.

This express commercial warranty is extended by Motorola to the original end user purchaser or lessee only and is not assignable or transferable to any other party. This is the complete warranty for the Product manufactured by Motorola. Motorola assumes no obligations or liability for additions or modifications to this warranty unless made in writing and signed by an officer of Motorola. Unless made in a separate agreement between Motorola and the original end user purchaser, Motorola does not warrant the installation, maintenance or service of the Products.

Motorola cannot be responsible in any way for any ancillary equipment not furnished by Motorola which is attached to or used in connection with the Product, or for operation of the Product with any ancillary equipment, and all such equipment is expressly excluded from this warranty. Because each system which may use Product is unique, Motorola disclaims liability for range, coverage, or operation of the system as a whole under this warranty.

This warranty does not cover:

a) Defects or damage resulting from use of the Product in other than its normal and customary manner.

b) Defects or damage from misuse, accident, water or neglect.

c) Defects or damage from improper testing, operation, maintenance installation, alteration, modification, or adjusting.

d) Breakage or damage to antennas unless caused directly by defects in material workmanship.

e) A Product subjected to unauthorized Product modifications, disassemblies or repairs (including without limitation, the addition to the Product of non-Motorola supplied equipment) which adversely affect performance of the Product or interfere with Motorola's normal warranty inspection and testing of the Product to verify any warranty claim.

f) Product which has had the serial number removed or made illegible.

g) A Product which, due to illegal to unauthorized alteration of the software/firmware in the Product, does not function in accordance with Motorola's published specifications or the FCC type acceptance labeling in effect for the Product at the time the Product was initially distributed from Motorola.

This warranty sets forth the full extent of Motorola's responsibilities regarding the Product. Repair, replacement or refund of the purchase date, at Motorola's option is the exclusive remedy. IN NO EVENT SHALL MOTOROLA BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT, FOR ANY LOSS OF USE, LOSS OR TIME, INCONVENIENCE, COMMERCIAL LOSS, LOST PROFITS OR SAVINGS OR OTHER INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGE ARISING OUT OF THE USE OR INABILITY TO USE SUCH PRODUCT, TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

SOFTWARE NOTICE/WARRANTY

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Service Information

This equipment complies with part 68 of the FCC Rules. On the rear of this equipment is a label that contains, among other information, the FCC registration number for this equipment.

- **Registration Number:** ABZUSA-23958-DE-N

If requested, this information must be provided to the telephone company.

An FCC compliant modular plug is provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack, which is part 68 compliant. See installation instructions for details.

- **USOC:** RJ48C
- **Facility Interface Code:** 04DUO-ISN
- **Service Order Code:** 6.0N

If the terminal equipment, integrated Site Controller, causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice is not practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.

If trouble is experienced with this equipment, integrated Site Controller, please contact the Customer Support Center at 1-800-499-6477 for repair or warranty information. If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

None of the integrated Site Controller boards are field repairable. For assistance in sending the boards back for repair, the customer should contact the Customer Support Center.

This equipment cannot be used on public coin phone service provided by the telephone company. Connection to party line service is subject to state tariffs. Contact the state public utility commission, public service commission, or corporation commission for information.

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Manual Overview

Chapter overview

This chapter briefly describes the contents of the iDEN integrated Site Controller (iSC) System Manual.

Scope of the Manual

This manual is a supplement to the EBTS System Manual 68P81099E10. The iSC System Manual is intended for trained technicians experienced with Motorola base radio equipment or similar types of equipment. Motorola recommends reading the entire manual before attempting to install or operate the iSC equipment.

This manual is divided and organized into twelve major sections plus appendices. The user of this manual can quickly locate each of these sections by locating the appropriate tab. Some sections are divided even further into subtabs. All major sections are listed in Table 1-1.

Table 1-1 ***Manual contents***

Chapter	This chapter . . .
Manual Overview	briefly describes the contents of the integrated Site Controller (iSC) system manual
System Description	identifies the major components and functions of each unit in the integrated Dispatch Enhanced Network (iDEN™) system.
Pre-Installation	describes pre-installation considerations for the iSC
Installation	includes detailed procedures for installation of the iSC
Final Checkout	includes a detailed checkout procedure that is performed after installation of the iSC
System Testing	covers test procedures for various functions of the iSC
System Troubleshooting	contains troubleshooting tables used to help isolate faults to a Field Replaceable Unit (FRU)
Software Commands	defines each of the Man-Machine Interface (MMI) commands and presents the proper syntax
Controller	describes the iSC and its associated hardware
iMU	describes the iDEN Monitor Unit (iMU) and its associated hardware
FRU Replacement Procedures	includes removal and installation procedures for the FRUs in the iSC and associated hardware

Quality Standards

The installation section of this manual requires the *Quality Standards-Fixed Network Equipment (FNE) Installation Manual (R56)* as a reference. The R56 contains on-site installation, integration, optimization, and maintenance information for trunked radio equipment. Technicians and installation personnel must be familiar with procedures and guidelines presented within that manual.

To order the Quality Standards Manual, contact:

Motorola Literature Distribution Center
2290 Hammond Drive
Schaumburg, Illinois 60173

847 576-2826

Repair and Technical Support

Motorola provides technical support services for installation, optimization and maintenance of iSC equipment.

Before calling...

Be sure to have the following information available prior to contacting Motorola Technical Support to help minimize down-time:

- location of the system
- date the product was put in service
- software versions of affected equipment
- symptoms of the problem
- date the problem was first noticed
- if the problem can be reproduced
- what causes the problem to occur
- any unusual circumstances contributing to the problem (i.e., loss of power)

Technical support

For support of Motorola infrastructures, call the following phone number. This phone number is not valid for technical support of mobile communications equipment.

(US) 1-800-499-6477

(International) 1-847-538-6898

Repair procedure

If a board should require service or repair, be sure to note the following:

- always use a static grounding wrist strap before handling any board or module

- include the warranty, model, serial, and kit numbers
- give a clear return address, including:
  - contact person
  - phone number
  - alternate contact and phone number (if possible)
- securely package the board or module in the original shipping carton, if available. Otherwise, package in a static protection bag in a well padded carton.

Note: iDEN equipment boards are not field repairable. Do not attempt to repair iDEN equipment boards in the field. For assistance, contact the iDEN Customer Support Center at the phone number listed in the *Technical support* paragraph.

Static Sensitive Precautions

The static grounding wrist strap (Motorola p/n 42-80385A59) supplied with the iSC must always be used when handling any board or module. Many of the boards or modules used in the iSC are vulnerable to damage from static charges.

Extreme care must be taken while handling, shipping, and servicing these boards or modules. To avoid static damage, observe the following precautions:

- Prior to handling, shipping, and servicing iSC equipment, always wear a conductive wrist strap connected to the grounding clip on the Cabinet. This discharges any accumulated static charges.

! WARNING !

Use extreme caution when wearing a conductive wrist strap near sources of high voltage. The low impedance provided by the wrist strap also increases the danger of lethal shock should accidental contact with high voltage sources occur.

- Handle modules by the edges and avoid touching any conductive parts of the module with your hands.
- Never remove boards or modules with power applied to the unit (hot-pull) unless you have verified it is safe to do for a particular board or module. Make sure the unit will not be damaged by this. Several boards and modules require that power be turned off prior to removal.
- Avoid carpeted areas, dry environments, and certain types of clothing (silk, nylon, etc.) during service or repair due to the possibility of static buildup.
- Apply power to the circuit under test before connecting low impedance test equipment (such as pulse generators, etc.). When testing is complete, disconnect the test equipment before power is removed from the circuit under test.
- Be sure to ground all electrically powered test equipment. Connect a ground lead (-) from the test equipment to the board or module before connecting the test probe (+). When testing is complete, remove the test probe first, then remove the ground lead.

- Place all circuit boards and modules on a conductive surface (such as a sheet of aluminum foil) when removed from the system. The conductive surface must be connected to ground through 100kΩ.
- Never use non-conductive material for packaging modules for shipment or storage. All modules should be wrapped with anti-static (conductive) material. Replacement modules shipped from the factory are packaged in a conductive material.
- If possible, retain all original packing material for future use.

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2

System Description

Chapter overview

This chapter provides a brief overview of the iSC and its function within the iDEN system. Topics covered in this chapter are listed in the following table.

Section	Page	This section . . .
EBTS Site Description	2-2	provides an overview of the EBTS system
integrated Site Controller	2-5	describes the function of the major components comprising the iSC, including: • PowerPC® • PSU • SRI • STP/SEP • ELP • T1 and Serial/Parallel Transient Protection • Front Panel Display • Expansion • iMU

EBTS Site Description

iDEN (integrated Digital Enhanced Network) is a digital communications system which combines the capabilities of a standard analog dispatch system with that of a cellular interconnect system. iDEN uses an advanced proprietary modulation technology consisting of a speech compression scheme enabling three or six communication paths over a single 25 kHz rf channel.

iDEN allows users with mobile and portable subscriber units to communicate with one another over the Public Switched Telephone Network (PSTN) using the rf system as the medium. The rf system consists of strategically located Enhanced Base Transceiver Systems (EBTS) which are linked to the Mobile Switching Office (MSO). The MSO in turn provides the connectivity to the PSTN. Refer to Figure 2-1.

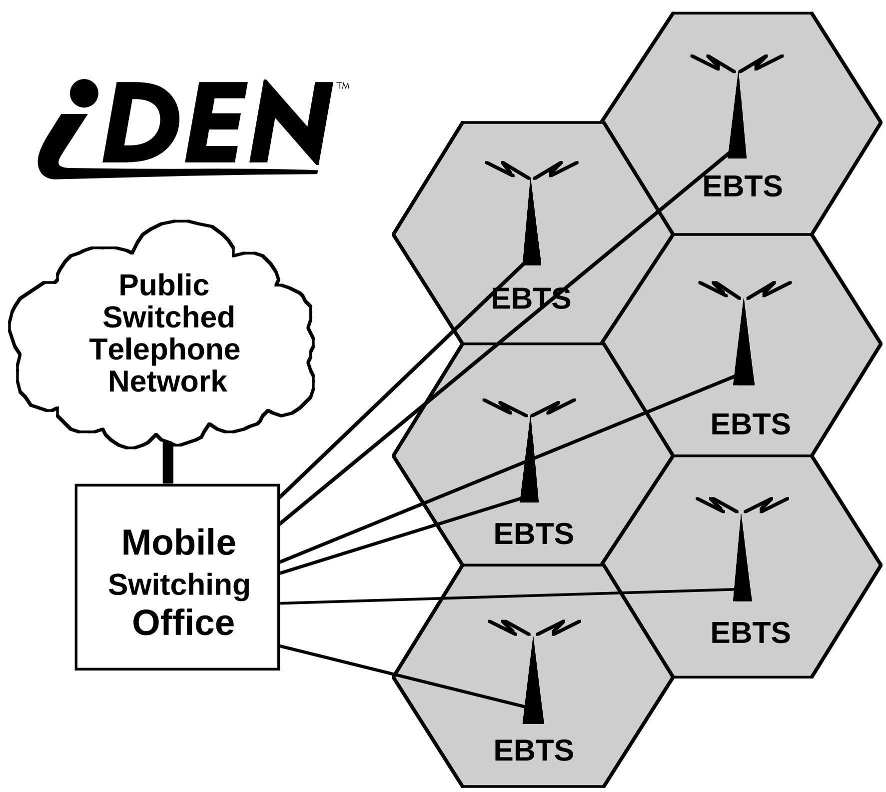


Figure 2-1 ***iDEN system diagram***

The EBTS site contains rf and Control equipment. It provides the radio communication link between the land network and the mobile and portable units. Each EBTS site consists of one or more rf cabinets and one integrated Site Controller (iSC). In the case of the SRSC and SRRC, the iSC resides in the rf cabinet. The iSC and rf cabinets are interconnected via an Ethernet LAN. The iSC also terminates the connection between the EBTS and MSO via a T1 span (or E1 for international markets). Refer to Figure 2-2. A diagram of a typical iSC rack is shown in Figure 2-3.

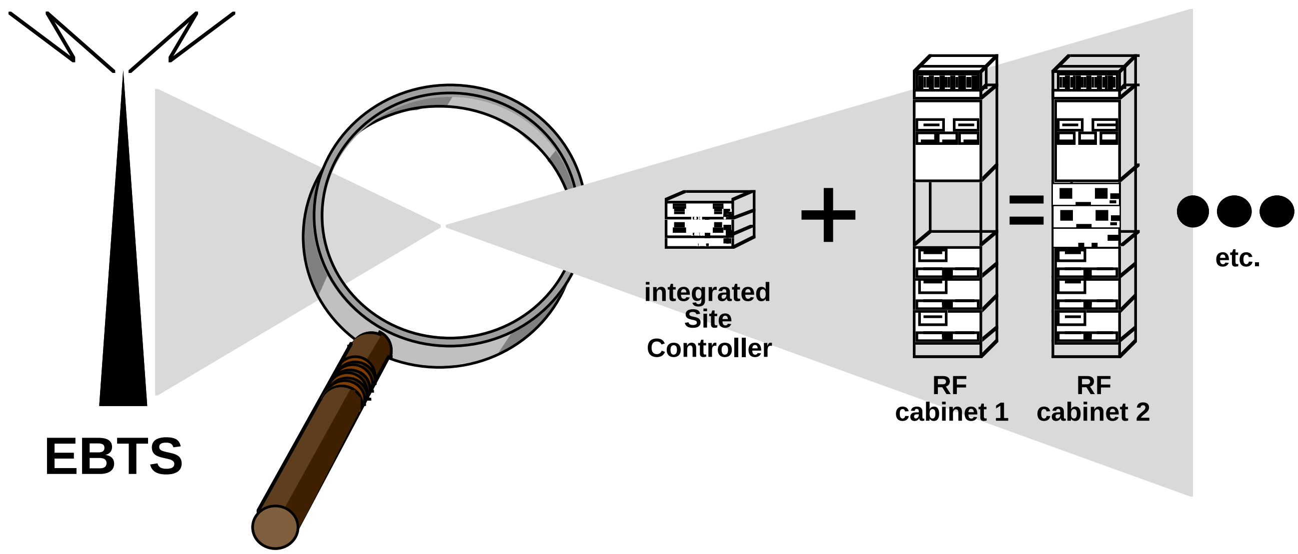


Figure 2-2 ***Inside the EBTS***

EBTS Site Description

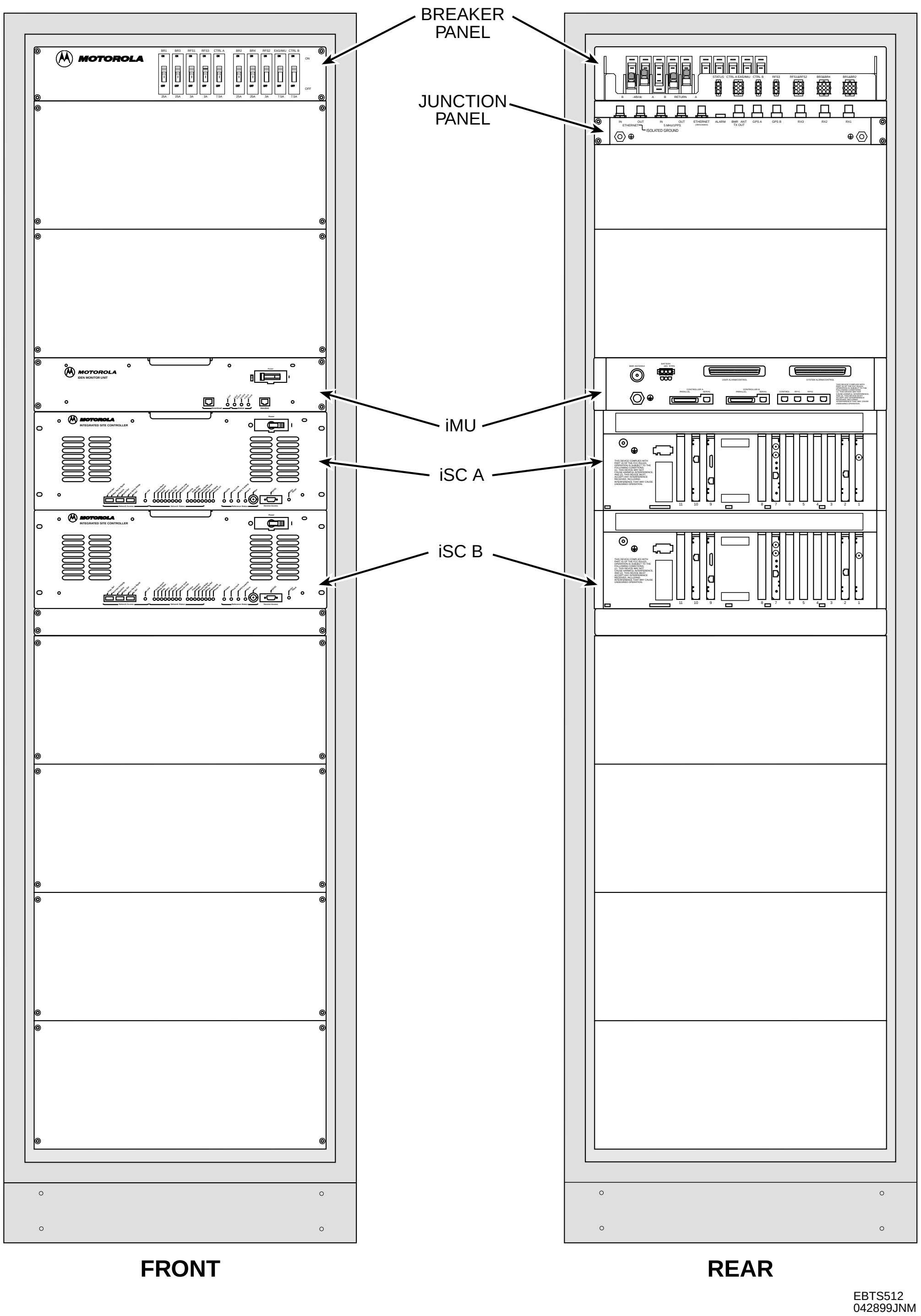


Figure 2-3 ***EBTS Control Cabinet***

integrated Site Controller

The iSC consists of at least two assemblies: a Controller and an iMU. Most systems are configured with two Controllers (a main and a standby) and an iMU. Refer to Figure 2-5 and Figure 2-6 for the front views. For a complete description of each assembly, refer to the appropriate chapter.

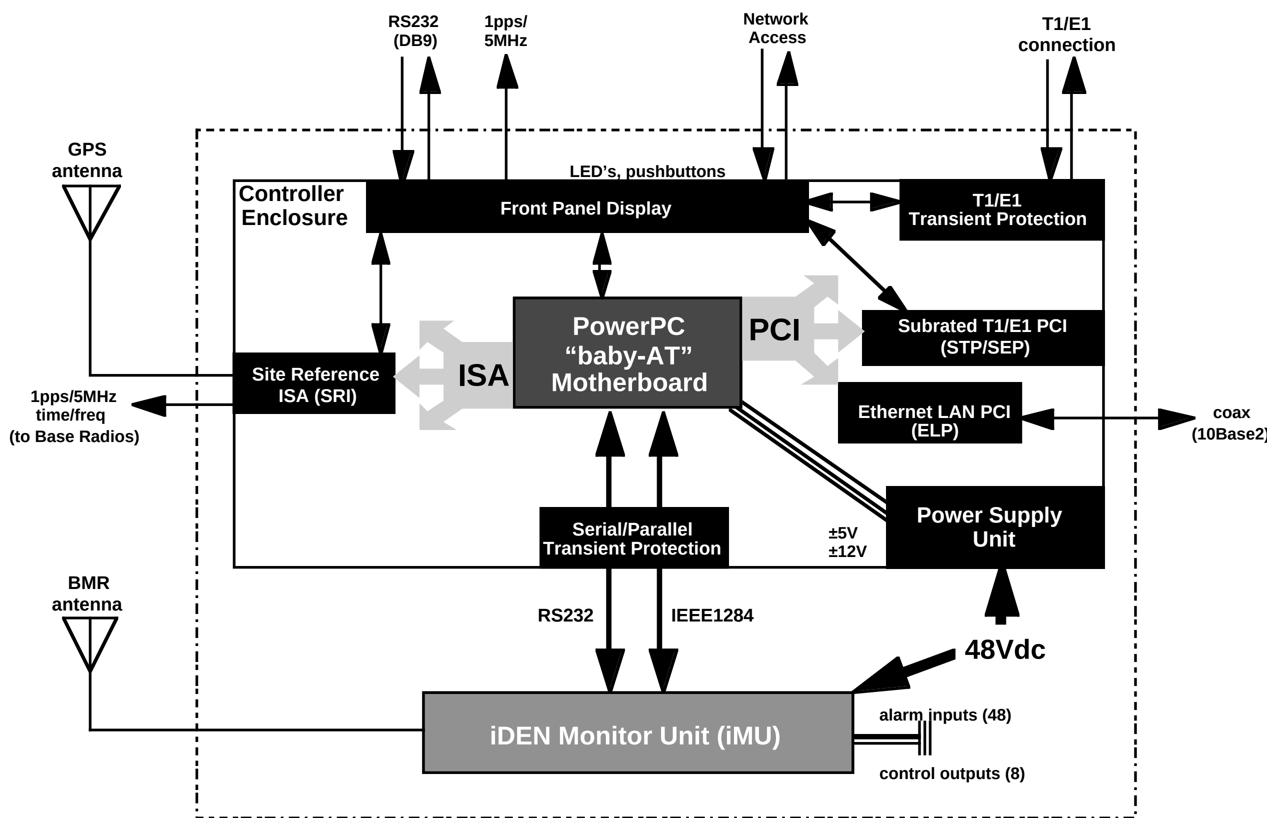


Figure 2-4 ***iSC Block Diagram***

Controller

A Controller consists of the following modules:

- **PowerPC™ motherboard** – The Controller centers around the PowerPC motherboard. Slots for PCI and ISA compliant cards are also included. The PowerPC CPU, memory, and expansion slots reside on the motherboard. The motherboard also supplies dc power to the peripheral cards.

- **Front Panel Display** – The Front Panel Display provides:
  - red, yellow, and green LED indicators for all major sub-systems
  - a BNC port to allow monitoring of time and frequency signals
  - a momentary pushbutton for initiating network loopbacks
  - a momentary pushbutton for resetting the CPU
  - bantam jacks for servicing the T1 network
  - a DB9 connection for service access
- **Power Supply Unit** – The Power Supply Unit receives -40 to -60 Vdc input and supplies +5, -5, +12, and -12Vdc to the motherboard.
- **Site Reference ISA card (SRI)** – The SRI is an "ageless" time frequency reference that provides the EBTS with accurate frequency and time information.
- **Subrated T1 PCI/Subrated E1 PCI card (STP/SEP)** – The STP card provides the site network interface between the Controller and T1 span. It is a PCI-compatible card that plugs into a PCI slot of the PowerPC motherboard. The STP card is a channelized sub-rated T1 or E1 interface card. The STP card supports one T1 link. The STP card also integrates much of the functionality of the Channel Service Unit (CSU) used in other systems. The SEP card provides the same functionality and interface for the E1 span.
- **Ethernet LAN PCI (ELP)** – The ELP provides the IEEE 802.3 10Base2 Ethernet interface between the Controller and the Base Radios. It is a PCI-compatible card that plugs into a PCI slot of the PowerPC motherboard.
- **T1, E1, and Serial/Parallel Transient protection cards**– These cards provide transient protection for the serial/parallel data I/O originating at the PowerPC motherboard, and for the T1/E1 site network interface which protects the STP card. This enables the Controller to directly connect to networks requiring Part 68 type compliance.
- **Expansions** – One additional PCI slot and three ISA slots are available for future use.

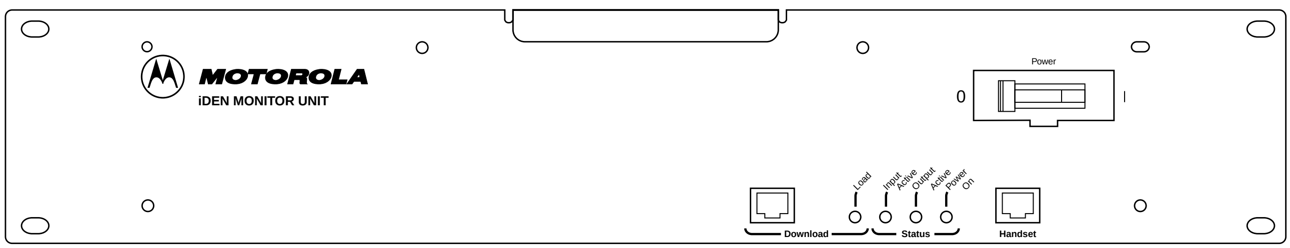
iDEN Monitor Unit

The iDEN Monitor Unit (iMU) combines the functionality of the current iDEN Environmental Alarm System (EAS) and Base Monitor Radio (BMR) in a two rack unit enclosure. The iMU communicates with both the main and standby Controller units over an RS232 serial interface and an IEEE1284 parallel interface.

The iMU can monitor up to 48 inputs, each of which must be a contact closure between the alarm input and its return. The alarm inputs are optically isolated. The iMU also provides eight relay outputs. Four RJ45 connectors replicate the physical interfaces to the three RF Cabinets and one Control Cabinet (as exists presently on the EAS). The remaining alarm inputs and relay outputs are accessible via two 50-pin Champ connectors. These connectors are cabled to punch blocks to allow simple installation of the remaining site alarm and control I/O.

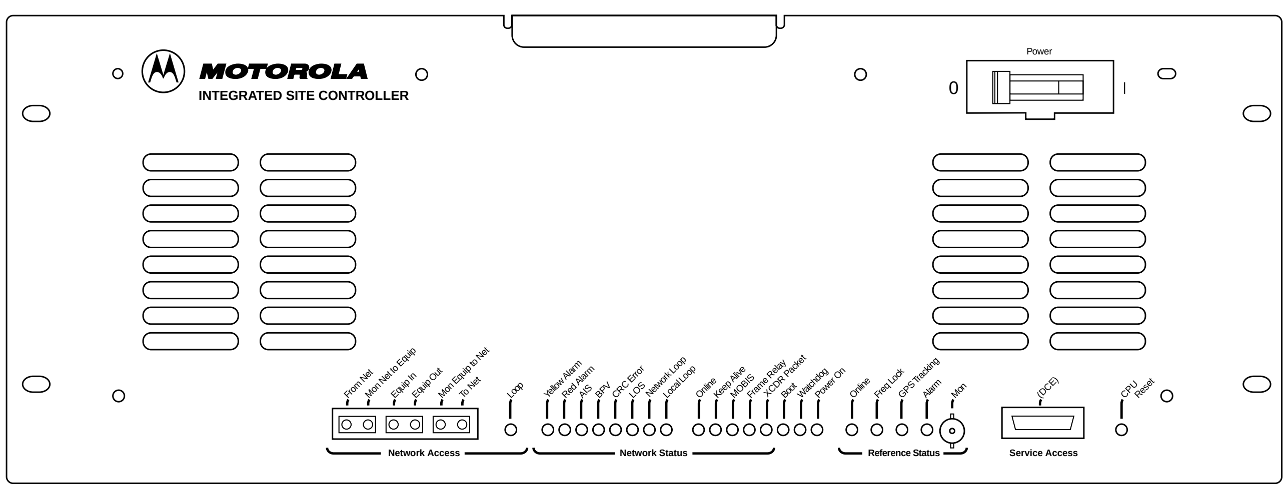
The BMR subsystem of the iMU contains an iDEN mobile subscriber unit for monitoring site operation.

The iMU contains its own power supply.



iSC042
060796JNM

iMU

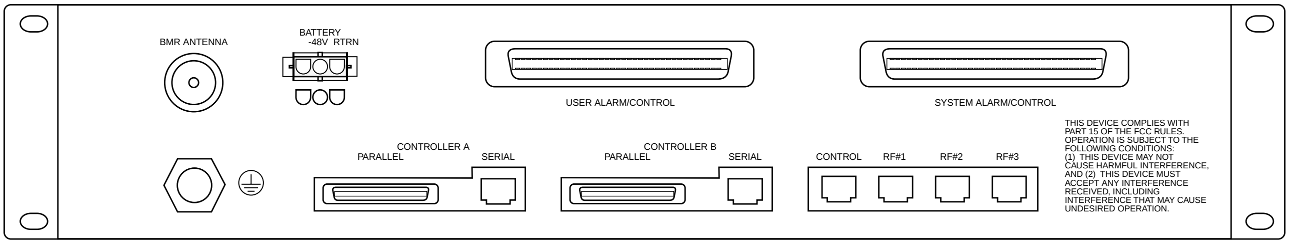


iSC045
090696JNM

Controller

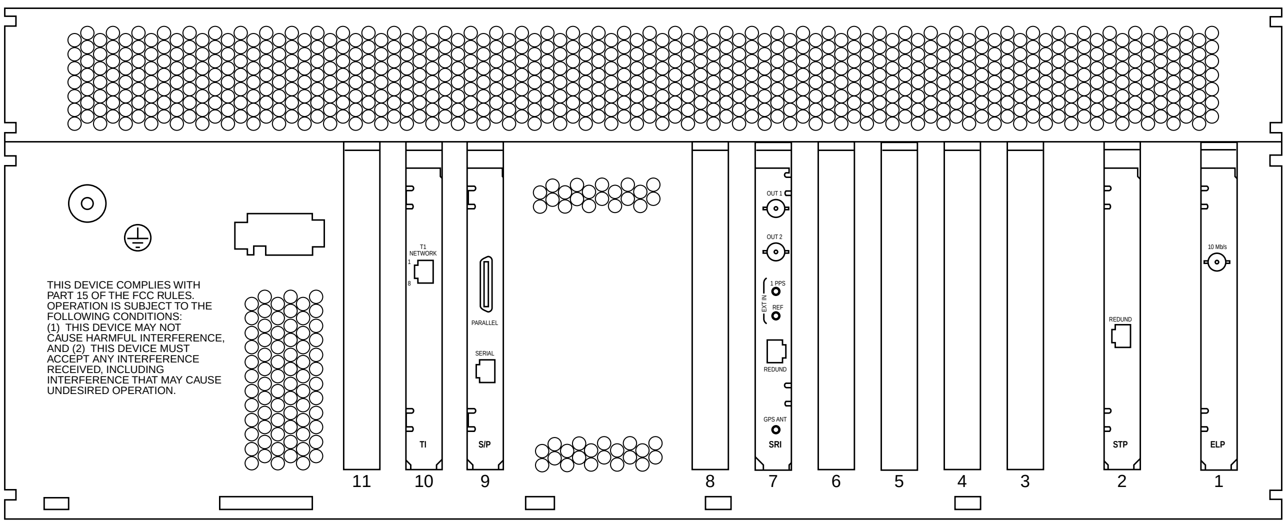
Figure 2-5 ***iSC front view***

integrated Site Controller



iSC027
052396JNM

iMU



iSC046
060796SN

Controller

Figure 2-6 ***iSC rear view***

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Pre-Installation

Chapter overview

This chapter provides pre-installation information for the preparation of an integrated Site Controller (iSC) site. Refer to the *EBTS System Manual (68P81099E10)* for EBTS-wide pre-installation issues.

A pre-installation site review and evaluation helps prevent potential equipment installation problems. Every subject discussed in this chapter must be considered prior to performing the installation of the iSC.

The topics of this chapter are listed in the following table.

Receipt of Equipment

Equipment inspection

Inspection of the iSC equipment must be performed as soon as all equipment is unpacked.

Note: If obvious damage has occurred to the shipping containers before unpacking, contact the shipping agent and ask that a representative of their company be present while the equipment is unpacked.

Observe guidelines for safe handling of electro-static sensitive devices or equipment to prevent electrostatic discharge damage. A conductive wrist strap is provided with the iSC and should always be worn when handling any electrical component. Connect the wrist strap to the grounding clip on the Cabinet.

Inspect the following upon receipt of the iSC:

- check for loose or damaged equipment
- check all sides of each cabinet for dents, scratches, or other damage
- check all cabinet wiring to insure connections are in place
- check modules and boards for physical damage to controls or connectors
- verify that ground straps are secure

If any equipment is damaged, contact the shipping company immediately, then your Motorola representative.

Equipment inventory

Check the iSC equipment against the itemized packing list to insure that all equipment was received. If available, check the sales order with the packing list to account for all equipment ordered. Contact your Motorola representative to report missing items and for additional information.

Site Planning

Licensing and availability of space help to determine a site selection. On a Motorola owned or controlled site, field engineering and program management plan the system and site layouts. Planning helps to prevent potential on-site and off-site interference from other RF systems. Site layouts should always be planned to minimize the inter-cabling lengths between RF equipment.

Site considerations

The site building should not contain windows and must be able to resist extreme weather conditions. It should be designed to meet the requirements of the American National Standards, *Building Code Requirements for Minimum Design Loads in Buildings and Other Structures*.

Motorola recommends the following considerations when selecting a site:

- A minimum floor space of at least 200 square feet is recommended to allow enough space for front and rear access to the equipment cabinets.
- The minimum ceiling height of at least 8’-6” above a finished floor is required to allow enough space for the height of the equipment cabinets and cable access at the top of the cabinets.
- The ceiling structure should be able to support a cable tray assembly for routing the intercabinet cabling and other site cabling. The cable tray assembly is mounted to the site ceiling and walls per site plan and should be at least 7’-6” from the site floor to allow for the height of the equipment cabinets.
- The minimum door dimensions should be at least 3’ wide and 6’-8” high.
- All exterior doors should have tamper proof locks installed for security purposes.
- The interior site environment should be maintained at a constant 78° F (25.6° C). The site should be capable of maintaining this temperature in an outside ambient temperature range of -10 to +105° F (-23.4 to +40.6° C). iDEN equipment is not approved or recommended for outdoor use.
- Proper surge protection is required for all antennas and power inputs to prevent potential damage to the site equipment.

- The site floor should be level to within 1/8” and able to support the weight of the site equipment.

Rack configurations

Table 3-1 lists the dimensions for the Controller and iMU. Figure 3-1 shows the racking arrangement for the Controller and iMU.

Table 3-1 ***Controller and iMU dimensions***

Equipment	Chasis Width (inches)	Depth (inches)	Height (inches)
Controller	17	15	7
iMU	17	15	3.5

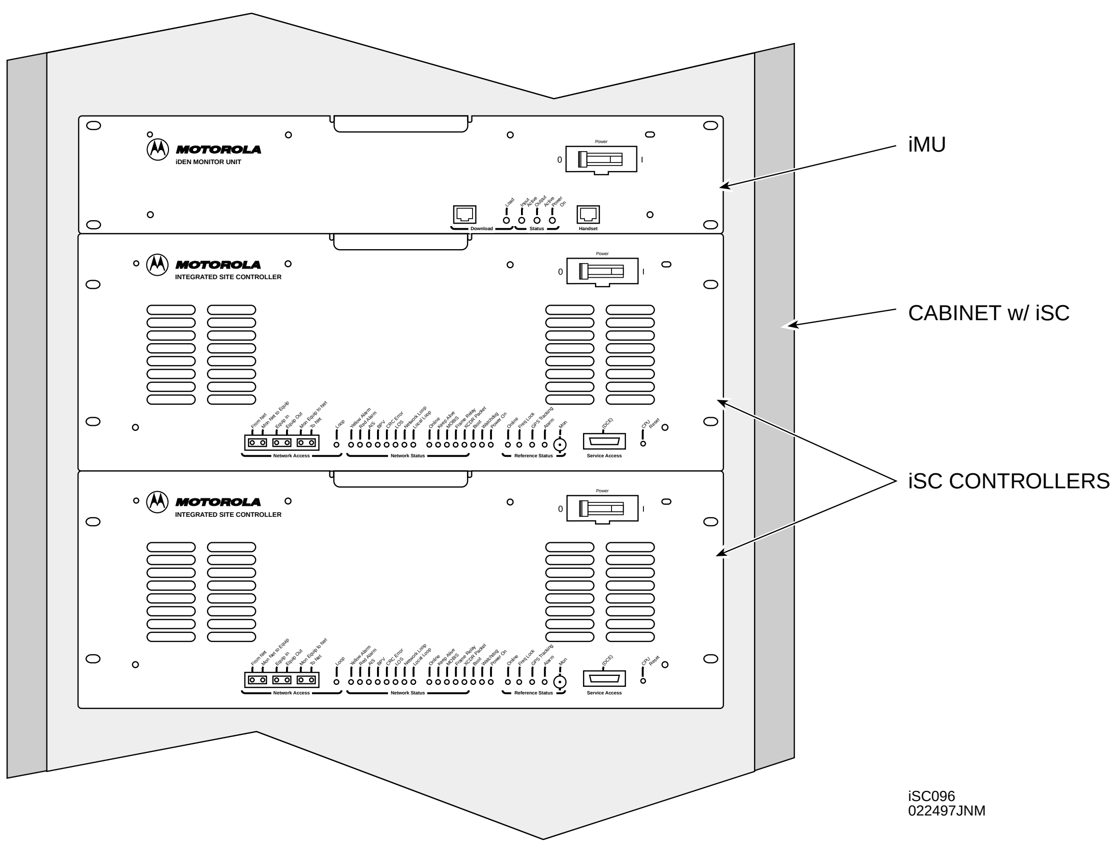


Figure 3-1 ***Typical iSC racking arrangement***

19 Inch Rack

The front panel of the iSC and iMU is 19” wide to allow for installation into 19” wide cabinets. The iSC and iMU are typically into a 19” wide cabinet prior to shipment.

23 Inch Rack

Hardware is available to allow for installation of the iSC and iMU into either a larger 23” wide cabinet or a rack. The cabinet type is a Cabtron Systems, Inc. cabinet supplied as part of the Power Conversion Products DC Power System. Racks are either three, five, or six, inches deep.

The Expansion Kit containing the 23” rack mounting hardware is CLN1266A. It contains the angle brackets, main brackets, junction panel, and hardware necessary to mount the iSC and iMU in a 23” cabinet or a rack.

Installation of the iSC/iMU in a Cabinet/Rack

1. Determine the correct mounting position for the angle brackets to the main brackets based on the dimensions of the cabinet/rack. Attach the angle brackets to the main brackets using M4 screws.

2. Attach the assembled brackets in the cabinet or rack using the appropiate hardware provided, or hardware provided by the cabinet or rack supplier. For the Cabtron cabinet, it is desirable to attach the angle brackets to both the front and rear rail of the cabinet. For racks, it is desirable to attach the angle brackets to both the front and rear of the rack.

3. Attach the junction panel to the bracket assembly using the M6 screws provided (4 places). The junction panel mounts at the top of the brackets.

4. Install the controllers and the iMU. Secure the front panels with M6 screws.

5. Cable the units as shown in the installation section and cabling diagrams of this manual. There are several clearance slot in the angle brackets that allow ground cables from the Integrated Site Controller components to be attached to the rack or cabinet rails. The junction panel has ground studs for that purpose.

Site Planning

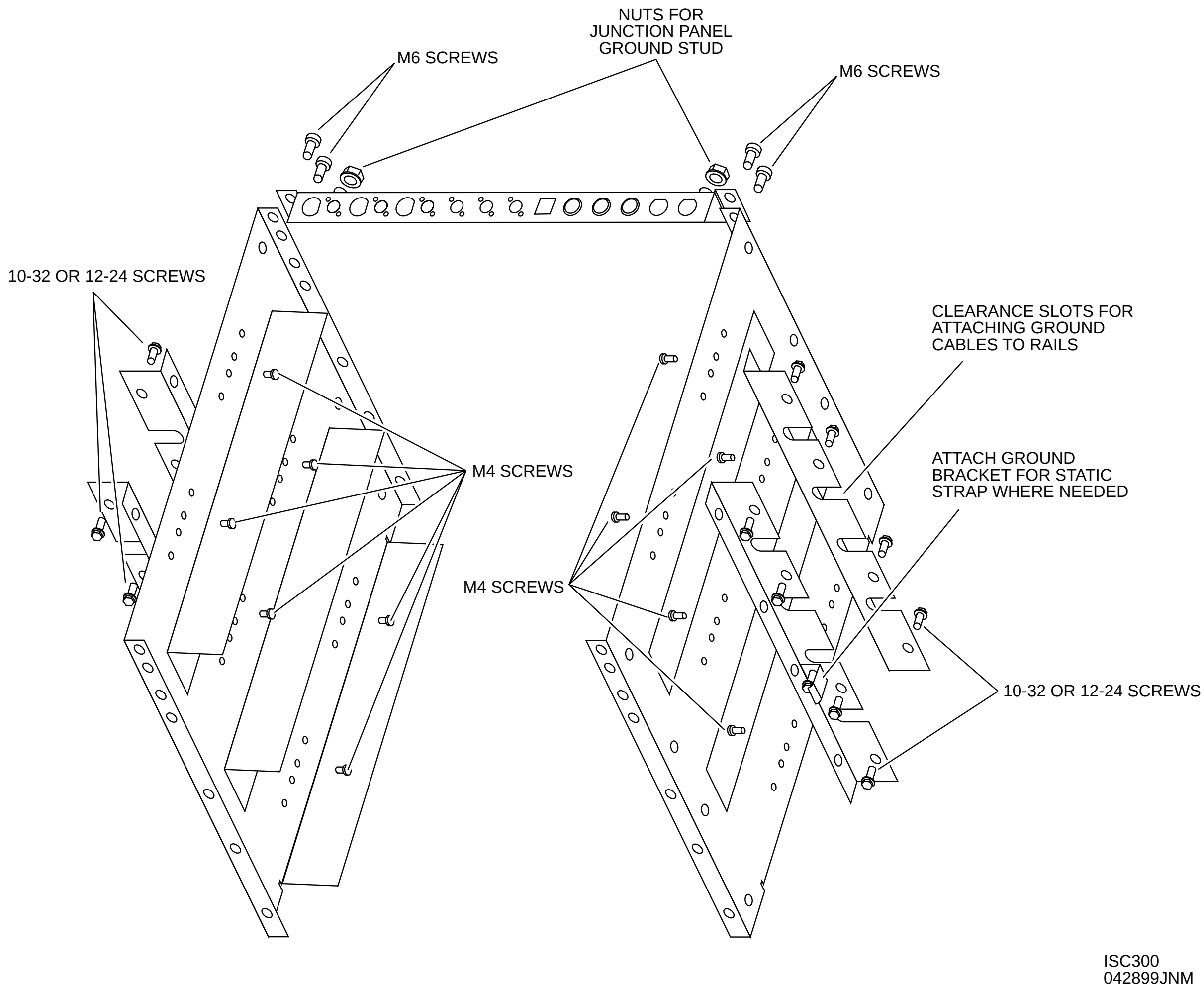


Figure 3-2 ***Assembly for mounting on a 3 to 6 inch deep rack***

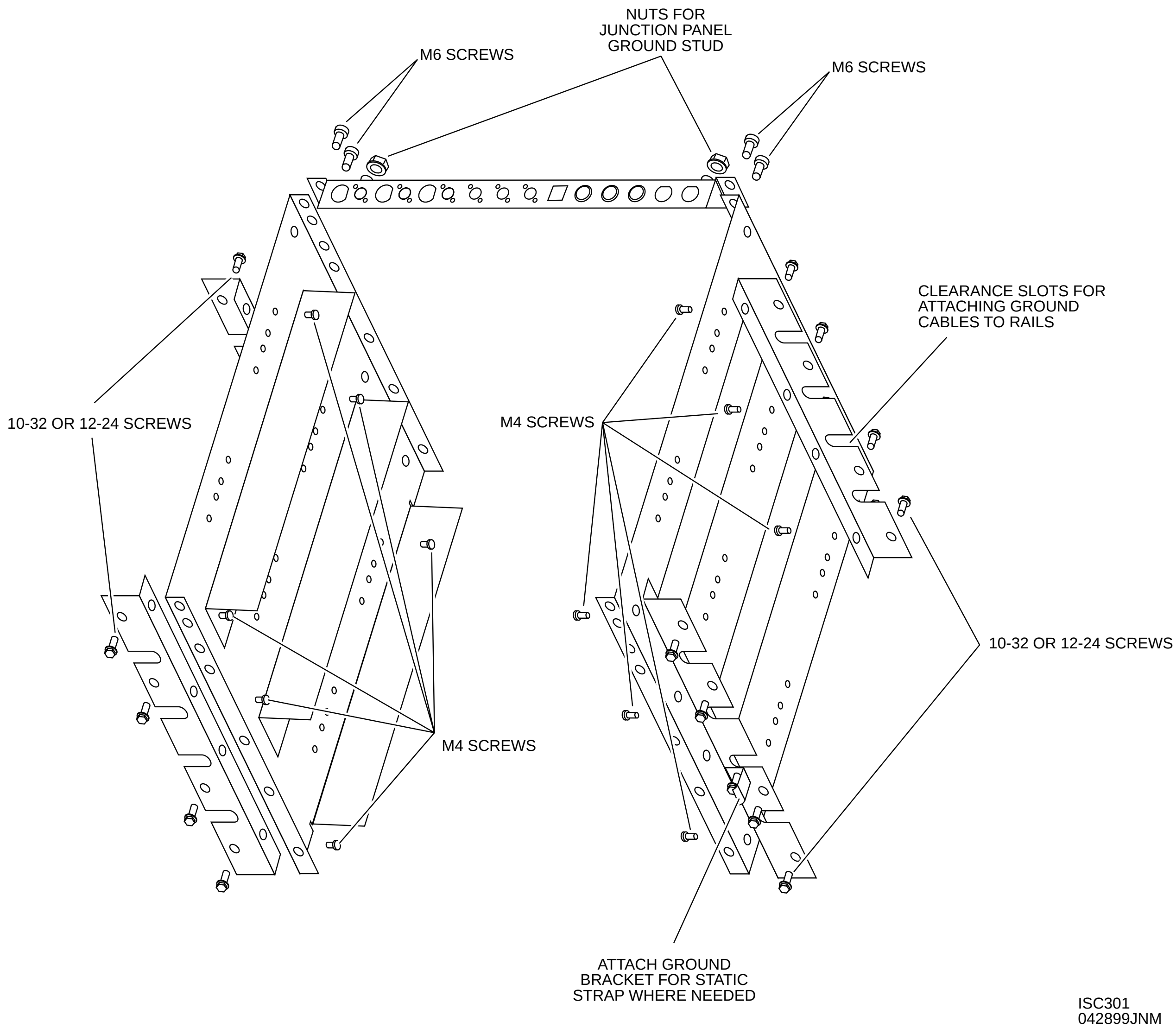


Figure 3-3 ***Assembly for mounting in a Power Supply cabinet***

Special considerations

Breaker panel access

The National Electrical Code (NEC) requires a 36” clearance for electrical service access to all fuse panels, breaker panels, etc., and requires that all doors to this equipment open to at least 90˚.

Disabled personnel

The customer is responsible for determining the applicable Americans with Disabilities Act (ADA) requirements that apply to the site. The ADA requires certain clearances for handicapped personnel.

One ADA requirement that should be considered is a 36” wide aisle for wheelchair-bound personnel. The aisle must include an adjacent “T” shaped area to allow room for maneuvering a wheelchair.

Hazardous materials and equipment

Note: The following information is provided as an aid for the planning of a site. Compliance with all local, state, and federal regulations concerning the handling and use of hazardous materials and equipment is the sole responsibility of the customer and associated agents.

The proposed site must not have imminent hazards present in the form of hazardous materials (stored or spilled), harmful or dangerous conditions, or exposure to RF energy levels in excess of ANSI Occupational Guidelines.

If asbestos removal is required, it must be removed by a certified asbestos remover from the site improvement area or from places where it would be disturbed during site construction.

Floors containing asbestos may be left intact. However, drilling or penetration of the floor must be done in accordance with federal and state clean air guidelines. It is recommended that drilling be performed by a certified asbestos remover.

After any removal of asbestos, a certificate of air cleanliness for the site must be obtained from the contractor.

The standard battery system uses valve-regulated batteries which are designed for telecommunication applications. These batteries are also referred to as sealed or maintenance-free lead-acid batteries. Motorola recommends that these batteries be stored, transported, and installed by a certified hazardous material handler. Many regulatory agencies classify batteries as hazardous material. Special permits and safety equipment may be needed.

Seismically active areas

Sites that are in seismically active areas may require additional bracing of the equipment cabinets. This manual does not contain specific procedures related to seismic bracing.

Telephone Company (Telco) line interface

Telco surge arrestor

A surge arrestor must be installed at the T1/E1 service entrance. The arrestor must be designed for operation with a T1/E1 telephone circuit. The arrestor must only be installed on the customer side of the T1/E1 service entrance. It should be wired per manufacturer instructions.

Telco service entrance

A rigid conduit sleeve must be installed to provide the service entrance into the site building. The conduit must be 2" in diameter and a PVC elbow should be attached (pointing down) on the outside end of the conduit. The conduit must be grounded in accordance with the *Quality Standards-Fixed Network Equipment (FNE) Installation Manual (R56)*.

Telco backboard

A wall mounted AC grade fire-rated plywood backboard (1/2"x4'x4') must be provided within the site. Reserve a two square foot area on the Telco backboard for dedicated system use.

A 117 VAC dual receptacle outlet (3 prong) should be installed on or adjacent to the Telco backboard. This outlet can be used for accessories, such as modems and other AC powered devices. It may also be used as a general service outlet.

Environmental considerations

Temperature control

The environment in which the iSC operates is an important consideration. The temperature should be regulated to ensure trouble-free operation. Lower temperatures will reduce battery capacity, but prolong life. Excessive temperatures result in generated heat that may reduce the life span of electronic equipment, and could cause permanent damage.

To combat temperature problems, a Heating/Ventilation/Air-Conditioning (HVAC) system must be used. All HVAC systems should be thermostatically controlled.

To prolong equipment life, the internal temperature of the system site should be maintained at a constant 78° F ±10° F (25.6° C ±5.5° C). The site should be capable of maintaining this temperature in an outside ambient temperature range of -10 to +105° F (-23.4 to +40.6° C). iDEN equipment is not approved or recommended for outdoor use.

The environmental equipment must be rated such that it is able to maintain the environment to meet the equipment heat dissipation values, which are given in British Thermal Units (BTUs)/per hour.

BTU/h can be figured by multiplying the power rating of the equipment by a factor of 3.414. For example; a Cabinet with a standby Controller produces 160 Watts, which is equivalent to 546 BTU/h (160 x 3.414 = 546 BTU/h).

The iSC equipment operates on a -48 Vdc power system including batteries. Should AC power be lost, the DC power system continues to supply the iSC equipment with the necessary power. Because the iSC remains operational during loss of AC power, heat is still generated by the equipment. Unless the site HVAC is on a backup system, the generated heat will affect the operation of the equipment. The operation of the iSC equipment degrades when temperatures exceed 104˚ F (40˚ C).

For sites containing more than one-hour battery backup, the effect of generated heat should be considered. The HVAC system design should be evaluated to insure the proper operating environment is maintained during loss of AC power.

Redundant HVAC systems

A redundant HVAC system may be installed, if necessary. It must be wired on a delayed circuit to prevent both HVAC systems from starting up simultaneously. The HVAC system should be capable of automatically switching between the heating and cooling modes in response to the thermostat. The controls must ensure that both modes never operate simultaneously.

Existing HVAC systems

Existing building HVAC systems may be programmed to turn off during non-occupied hours. This type of HVAC system must be evaluated to insure that the site temperature is maintained.

Humidity control and air cleanliness

The relative humidity within the site should be less than 95% non-condensing, non-operating; 90% non-condensing while operating. The site should also be a relatively dust-free environment. Take proper measures to ensure the cleanliness of the site and that it remains a relatively dust-free environment.

Electrical Requirements

All electrical wiring for the site must meet the requirements of NEC and all applicable local codes.

AC service

The DC power system operates from a 50-60 Hz AC service. Either of the following services are required:

- 240/120 V single-phase, 3-wire
- 208/120 V three-phase, 4-wire

Equipment rooms constructed inside existing buildings that use higher voltage systems require a step-down transformer. A main disconnect switch located within the site is recommended.

Emergency generator and transfer switch

Some sites may contain permanently installed emergency generators, however, most telecommunications sites are equipped with connections for portable generators. Sites with permanently installed generators usually have an automatic transfer switch used to transfer the AC service from the utility power to the generator after the generator has started. Sites with connections for a portable generator require a manual transfer switch and external connector.

Generators and transfer switches must be capable of supporting the maximum load for the customer defined service area of the generator. Start-up loads that include the HVAC and rectifiers must also be taken into consideration when selecting a generator size. Motorola offers several different generators for the site.

In a shared site with multiple emergency power switches installed, each should be labeled with the associated system name with a weatherproof placard attached to or mounted next to the switch.

The site contains an iDEN Monitor Unit (iMU) that has eight dry contact closure outputs and 48 customer defined inputs. The relay closures are controlled from the Operations and Maintenance Center (OMC) and one may be used as a remote start for permanent generators, if desired. The customer defined inputs may be used to monitor permanent generator operation if desired.

Rectifier drops

The conduit for the rectifier drops should be sized to support a maximum of six individual 30 Amp, 240 VAC rectifier circuits. Wire drops to power the rectifiers must be installed per site plan and should reach within 5' above the site floor. Mark these wire drops with the appropriate circuit breaker panel numbers. Terminate the drops in an AC electrical junction box.

Each rectifier requires a single wire drop. The standard configuration contains two rectifiers. Up to four additional rectifiers may be added at the customers option. Motorola recommends installation of four separate rectifier drops to facilitate future expansion requirements.

Surge arrestors

A Motorola-approved surge arrestor must be installed adjacent to the AC power panel. Very short wire lengths between the arrestor and the power panel are required for proper operation.

For sites using a transfer switch, the arrestor must be installed on the panel side of the transfer switch. Additional arrestors may also be installed at the customer's option on the line or generator side of the switch.

Motorola has developed a functional specification that can be used to help select various surge arrestors. This specification is available to all customers and can be obtained by contacting your iDEN System Manager.

48 Vdc power system

The iSC operates on a DC power system that includes a -48 Vdc battery system. Motorola offers a DC power system to compliment the iSC. All references to the DC power system within this manual assume the use of the Motorola power system; however other systems may be used.

This manual only provides procedures for the -48 Vdc battery system. If other DC power systems are used, then consult the manufacturer's documentation supplied with the equipment.

DC power reference

The iSC operates from positive ground, 48 Vdc power. Reference is made throughout this manual to the -48 Vdc (hot) and the DC return power leads. The hot and return leads are kept isolated from chassis grounds in the equipment.

The positive (+) return lead is grounded at a single point on the rectifier load return bus. Table 3-2 shows the color coding for these wires.

Table 3-2 ***48Vdc power bus color coding***

Description	Battery connection	Wire color
-48 Vdc (nominal)	negative (-)	red
DC return	positive (+)	black
NOTE: The hot side is negative polarity (-) in the 48 Vdc system power bus and the ground side is positive polarity (+).		

Cabinet requirements

Proper sizing of the rectifiers and batteries is accomplished by the iDEN System Manager when the iSC is ordered. The information in Table 3-3 is provided for customers that prefer to design a unique DC power system. This table lists the power system requirements of the Cabinet.

Table 3-3 ***Cabinet power system requirements***

Configurations	Requirement
DC power system: *	
minimum	-40 Vdc
maximum	-60 Vdc
Cabinet:	
with standby Controller	300 Watts
without standby Controller	200 Watts
* Voltage is measured at the circuit breaker panel input of the equipment cabinets.	

Grounding Requirements

The site must meet certain specifications for adequate protection from lightning induced transients. Proper ground installation methods are outlined in the *Quality Standards-Fixed Network Equipment (FNE) Installation Manual (R56)*.

Ground rings

Two separate ground rings should surround the site building and antenna tower. Ground rods (8') should be driven into the ground at 10' intervals for average soil. The two ground rings should be bonded together with one wire, buried at least 18" underground, or below frost level.

These ground rings are referred to as the exterior primary ground and must be at least #2 AWG tinned copper wire, solid or stranded. All connections to the rings should be made by exothermic welding. All exothermic welded connections should be treated with cold galvanizing spray.

Inspection wells should be provided for access to the buried ground system to allow verification of ground resistance. The ground resistance should be less than 5Ω .

Tower grounding

Ground each leg of the antenna tower with an 8' ground rod driven near each leg. All ground connections to the antenna tower must be exothermically welded. Do not weld directly on tower structural members; weld only to provided tower grounding tabs or to tower feet.

Note: Make sure that welding ground connections to the antenna tower does not void the warranty of the tower.

Metal monopole towers require a minimum of three 8' long ground rods to be driven into the ground, spaced approximately 10' apart. These ground rods may be exothermically welded to the bottom portion of the mast itself, to the monopole footing, or to the grounding connection tabs provided.

Site building and equipment grounding

On stand-alone site buildings, a PVC (typically 3/4”) conduit must be provided for the interior ground wire to exit the building. For site buildings with floors at ground level, the conduit must exit a side wall at a 45˚ angle or less. For buildings with space below the floors for a ground connection, the conduit may exit through the floor. In both cases, the location of the opening should be close to the master ground bar inside the building.

Use of metal conduit is discouraged as the conduit provides inductance to a surge, raising the impedance of the ground. If metal conduit is required by local building codes, both ends of the conduit must be bonded to the ground wire through the use of grounding clips or other suitable means to eliminate the inductance of the conduit.

Cabinet grounding

Within the site, ground the cabinets with a single dedicated connection between each cabinet and the master ground bar. The connecting wire must be a #2 AWG green-insulated copper wire.

Use two-hole mounting lugs (and split ring lock washers when possible) with an anti-oxidant grease applied for interior grounding connections and exterior secondary grounding connections. If lock washers are used, they should be placed between the nut and the lug to ensure the mechanical integrity of the connection. The washer must not be secured between the lug and the surface to which it is connected. Painted connections must be scraped clean before applying the anti-oxidant grease and lug.

! WARNING !

Never use a bare or damaged wire for the connection of chassis ground or other electrical wiring to prevent damage to equipment or potential injury to personnel.

Note: Each cabinet frame must be connected to the site ground using a single dedicated ground wire, except for RF Cabinets containing cavity combining systems.

The site ground wire should drop into the top of each cabinet and be connected to a single designated grounding stud. Single hole lugs (1/2” diameter) are used for these grounding connections. Connect the ground wires as follows:

Note: On the iSC, the ground wires are attached to the ground on the rear of the iMU and Controller housings.

CAUTION

DO NOT daisy-chain multiple equipment cabinet grounds using a single ground wire. Doing so increases the overall inductance of the ground wire which can distribute surge energy among the cabinets instead of to the master ground bar.

The equipment cabinets are classified as surge producers due to external coaxial cable connections. Surges from outside the site can enter the site grounding system via the coaxial cables. To prevent damage to the equipment, each cabinet must be connected to chassis ground through a minimum wire size of at least #2 AWG. Green insulated wire must be used to identify all ground wiring.

Cable tray grounding

The cable tray assembly must be designed and installed so that it does not come into contact with metal conduits, pipes, or other metal objects. The cable tray assembly must also be connected to the master ground bar through the use of a single dedicated wire. The connecting wire shall be a minimum size of #6 AWG green-insulated copper wire.

Any metal-to-metal joints on the cable tray assembly must be bonded together with a wire jumper to prevent electrical discontinuity, unless the tray connectors are specifically designed to insure continuity. Painted surfaces on the cable tray assembly must be scraped clean at the point where the jumper wire is attached to ensure a good electrical connection. Repaint cable tray assembly surfaces, if necessary.

Electrical system grounding

The site electrical system should be connected to the internal ground bar by a single connection. This should be from the panel/sub-panel in the equipment room with a #2 AWG stranded green insulated wire. For sites with sub-panels, the utility green Multi-Grounded Neutral (MGN) wire may not be present. In this situation, an electrician may need to be consulted to extend the MGN from the service entrance to the sub-panel. If this is done in metal conduit, then grounding clips should be used at both ends of the conduit to minimize inductance.

If metal conduit is used for the electrical system, all connections must be bonded together through conduit compression or screw fittings designed for such purposes. The metal conduit system must not be in contact with other metal on the site, including cable ladder or equipment cabinets, to minimize ground loops and sharing of surge energy. Small pieces of rubber or other insulating material may be used on conduit clamps to eliminate any inadvertent connections.

CAUTION

NEC prohibits grounding the AC power system neutral (white wire) anywhere other than at the service entrance panel. However, grounding of the MGN (green wire) at multiple locations is allowed.

Insure a good connection between the electrical system ground and site ground to prevent excessive voltage potential between the two ground systems during lightning strikes.

Antenna Installation

The iSC requires two types of antenna installations: one for the Global Positioning System (GPS) receiver, and one for the Base Monitor Radio (BMR) portion of the iMU. Refer to Table 3-4.

Table 3-4 ***Duplexed and non-duplexed antenna identification***

Color	Description
yellow	GPS antenna
white	BMR antenna

Antenna surge arrestors

All antenna feed lines should terminate with a suitable surge arrestor within 12” inside of the entry window. Each arrestor must connect to the master ground bar located below the entry plate. It is recommended that the arrestors be mounted to a mounting bracket to simplify grounding and cable installation.

GPS antenna planning

The iSC obtains precise timing information from the GPS. This system permits all sites in the area to synchronize to a common timing reference. The EBTS cannot operate properly without tracking satellites. The site planner must evaluate the proposed site antenna locations prior to the installation of the system.

GPS antenna evaluation

The Site Reference Industry Standard Architecture (SRI) card mounted within the Controller contains a GPS receiver that must locate and track at least four satellites during initial power-up. The four satellites are used to establish a three dimensional fix (latitude, longitude, and altitude) for the site. This process takes approximately 13 to 25 minutes to complete.

Once the position of the site has been established, the corresponding data is stored in memory and normal operation resumes.

GPS tracking criteria

To allow a system to successfully initialize, the Position Dilution Of Precision (PDOP) must be less than 10.0. A PDOP greater than 10 in a site that has been reset will delay the start-up of the system. To minimize the potential for the delay, Motorola recommends not having the PDOP greater than 10 for periods greater than 15 minutes.

Once a system is operating and the Base Radios have been keyed, a PDOP greater than 10 will not affect site performance, as long as at least one satellite is being tracked. However, to maintain maximum reliability, three satellites should be tracked at all times.

The system must be capable of the following:

- Tracking a minimum of four satellites during initial start-up or after loss of power to the SRI.
- Tracking three satellites continuously for maximum reliability.
- To allow the site to restart in the event the SRI is inadvertently reset, periods where the PDOP is greater than 10.0 should be minimized.

GPS evaluation kit

The Motorola GPS evaluation kit can be used to evaluate the site and antenna mounting location prior to site acceptance. Although many GPS receivers are available, the Motorola GPS evaluation kit includes the same receiver and antenna used in the system. The data reported by this kit is the same as that used by the system, if the antennas were installed in the test locations.

The evaluation kit includes software programs and the instructions for collecting the necessary site evaluation data. The necessary data includes:

- Dilution Of Precision (DOP)
- DOP type (Position or Horizontal)
- number of visible satellites
- number of satellites being tracked

GPS antenna requirements

The two GPS antennas should be mounted at least 10’ apart with an unrestricted aerial down view to within 10° of the horizon in all directions. This provides a degree of redundancy in case the antennas are damaged by falling objects or inadvertent shadowing.

The antennas must be mounted high enough to clear the peak of the site roof. For systems in the northern hemisphere, GPS antennas should be mounted so that a clear view of the southern sky is maintained. For systems in the southern hemisphere, GPS antennas should be mounted so that a clear view of the northern sky is maintained.

Isolate the GPS antennas from RF interference by mounting the antennas at least 12’ horizontally from other transmitting antennas.

Adjacent structures, such as trees or buildings, are obstructions due to their wide, solid profiles. Mount the GPS antennas to clear these obstructions and provide a clear path. Adjacent antenna towers at the RF site which protrude into the required view have a minimal effect on GPS satellite reception and are not obstructions.

Note: The color coding schemes identified within this manual are a recommendation only. The purpose for identifying specific colors is an attempt to obtain uniformity between sites. Other color schemes may be used.

GPS antennas are color coded yellow. The same identification technique used for RF antennas is also used to identify the GPS antennas, refer to Table 3-5. Antenna 1 should always be the northern-most antenna.

Table 3-5 ***GPS antenna identification***

Band	Description
one yellow band	GPS antenna 1 (northern-most)
two yellow bands	GPS antenna 2

GPS antenna line loss

The maximum allowable line attenuation between the antenna and the SRI is 6 dB. In addition, there is a 4 dB foliage margin. Installations in which the antenna has an unobstructed view of the sky may have a maximum line attenuation of 10 dB. In a typical installation using 1/2” low density foam coaxial cable, the length of the cable run should never exceed 150’. This is sufficient for most installations.

When considering the use of larger cables, calculate the cable lengths allowing a maximum allowable line attenuation of 4.5 dB at 1.5 GHz. The remaining 1.5 dB of attenuation is provided by interior site cabling and connectors.

Another option is the use of in-line amplifiers to overcome excessive line loss. The in-line amplifiers are powered by the 5 Vdc supplied by the GPS receiver and are inserted somewhere between the GPS antenna and the SRI, preferably near the antenna. Either the connector on the coaxial line must be changed to fit the amplifiers, or a short jumper cable must be field fabricated.

BMR antenna planning

The BMR antenna must be designed to provide an adequate RF link with the co-located site without introducing overload/de-sense/intermodulation.

A fixed attenuator attached to the BMR antenna port may be necessary. Attenuator values will vary with each site. The proper combination of antenna mounting location, antenna type and gain, and attenuators must be chosen to allow the BMR to function as desired within the system.

BMR antenna type and gain

An omni-directional, narrow vertical beamwidth antenna, with an operating range suitable for the specific system, is recommended for the BMR. This type of antenna provides an adequate signal to/from the BMR while helping to achieve the necessary local isolation.

BMR antenna mounting location

For most installations, the Motorola BMR antenna positioned outside the cell site building is sufficient for proper BMR operation. In some cases, the antenna must be mounted on the cell site building rooftop.

To avoid possible overload/de-sense/intermodulation at the co-located site, the antenna should be mounted so the maximum possible isolation exists between the BMR and the co-located cell site antennas. Trial and error may be necessary to achieve an optimum mounting location.

BMR transmission line attenuators

The BMR antenna connection is compatible with N-type RF connector. Refer to the Parts and Suppliers appendix for recommended BMR attenuators.

Alarm Wiring

Various alarms or sensors are installed within the site building. All alarm wiring terminates at the iMU. The electrical contacts for the alarms must be dry contacts and remain normally closed (open on alarm).

Motorola recommends site installation of the following alarms:

- smoke detector (120 Vac)
- intrusion alarm
- high temperature sensor
- low temperature sensor

The high temperature sensor should be capable of monitoring temperatures above 80˚ F (26.7° C). The low temperature sensor should be capable of monitoring temperatures below 70° F (21.1° C). Temperature sensors should be mounted to the Telco wiring board at a convenient height to facilitate the setting and inspection of the trigger points.

Local codes may require an additional contact closure to deactivate the HVAC system and prevent circulation of smoke in the event of a fire. An additional smoke detector may be used to provide this contact. It can also be configured to trigger an external alarm, if required.

If a second alarm closure is used, it must be completely isolated from the dedicated smoke alarm circuit. Parallel connection of the HVAC controller through these contacts may damage the HVAC and equipment. This is because the HVAC low voltage controller typically has 5 Vdc negative ground, which opposes the -48 Vdc supply.

If specialized automatic fire suppression systems are installed within the site, water flow alarms or Halon release alarms may also be required. These systems may also have to be remotely monitored for unattended facilities. Check your local codes for additional information and requirements.

Note: The use of Halon is now prohibited within the United States of America. However, if a Halon fire suppression system is currently in use, there may be alarm requirements that must be satisfied.

Alarm system wiring (standard iSC)

Alarm wiring fitted with modular (8-pin Telco) connectors terminate at the iMU, just as in the existing EAS. All other connections are designed to terminate at a punch block.

Each of the site alarm contacts are normally closed and connected to the iMU through a 50-pin Champ cable that connects to a punch block. All alarm contact pairs must be dry (isolated from ground). Most alarm connections are inputs. Outputs provide a dry relay closure rated at 0.5 Amps, 30 Vrms or 60 Vdc, 10VA max.

Four outputs on the User Alarm/Control and System Alarm/Control connectors are available for customer-defined applications. Diode suppression of inductive surges is required if anything but a resistive load is connected to this output.

Eighteen customer-defined alarm inputs are available on the User Alarm/Control connector. The alarms are reported to the Operations and Maintenance Center (OMC) by the respective alarm code. The OMC must be programmed with the proper alarm name corresponding to each code. All connections on User Alarm/Control and System Alarm/Control connectors must be defined and provided to the OMC to insure the effectiveness of monitoring those alarms.

The punch blocks are wired during pre-installation. Each alarm is connected to a pair of terminals on the punch block, the upper one of the pair represents the return and the lower one represents the hot side. For example, on the first numbered pair of the punch block 26 represents return and 1 represents the hot side. The punch block wiring as it appears within this manual is the recommended wiring.

Alarm Wiring

Table 3-6 lists the equipment required for pre-installation of alarm system wiring.

Table 3-6 ***Required alarm system equipment***

Part number	Description
3084966K01	50 pin Champ cable, 25' (for alarms)
0183652P01[1]	punch block
3084966K06[2]	50 pin Champ cable, 3' (to modular plug adapter)
2882174W03[2]	6 modular plug adapter

[1] Punch Block 2 is used strictly for customer defined inputs and outputs for systems with 3 or fewer RF racks. If 4 or more RF racks are used, see page 4-43 for redefinitions of Punch Block 2 pins for use with additional RF racks.

[2] Used only for systems with 4 or more RF racks. See page 4-37 for cabling information and diagram.

iSC site alarm wiring is connected using the following procedures. Refer to Figure 3-4 and Figure 3-5. Table 3-7 and Table 3-8 list the punch block pinouts.

1. Connect the necessary wires (alarms) to the punch blocks.
2. Connect the 50 pin Champ (alarm) cables to the punch blocks.

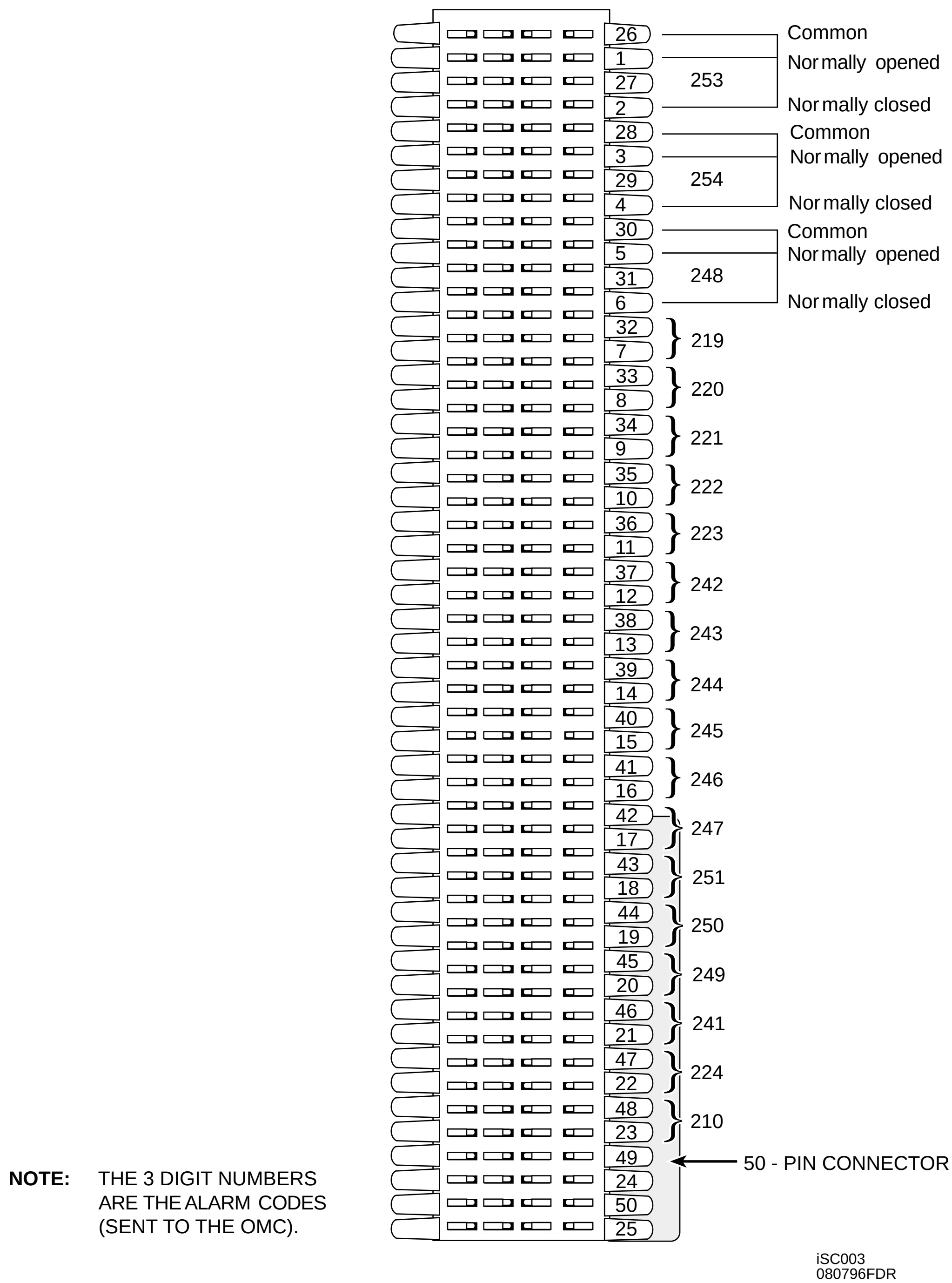


Figure 3-4 ***Punch block 1 - iMU pinouts***

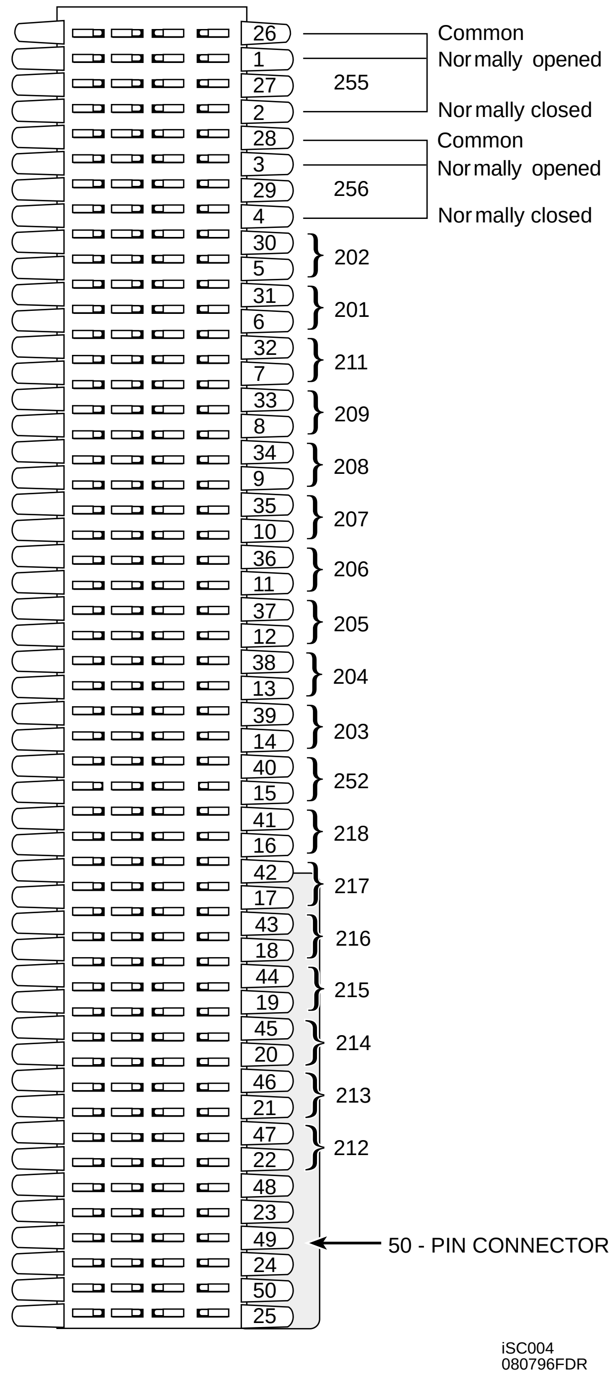
Punch block 1 - alarm connections

The iMU connector and pin label information refers to the connectors on the iMU itself. Only the alarm code number is passed to the OMC. Table 3-7 shows those alarms that connect from the System/Alarm/Control connector on the back of the iMU to punch block 1.

Table 3-7 ***Punch block 1 pin-outs***

Alarm code	Punch block pairs	iMU standard alarm connection
210	23, 48	reserved for system use
219	7, 32	predefined input, site entry
220	8, 33	predefined input, site high ambient temperature
221	9, 34	predefined input, site low ambient temperature
222	10, 35	predefined input, site smoke detector
223	11, 36	predefined input, site AC surge protector
224	22, 47	reserved for system use
241	21, 46	reserved for system use
242	12, 37	AC Power failure
243	13, 38	low DC voltage
244	14, 39	high DC voltage
245	15,40	breaker failure alarm
246	16, 41	minor rectifier module failure
247	17, 42	major rectifier failure
248*	30, 6, 5	pre-defined output generator remote start
249	20, 45	reserved for system use
250	19, 44	reserved for system use
251	18, 43	reserved for system use
253*	26, 2, 1	customer defined output
254*	28, 4, 3	customer defined output
* These alarms are outputs controlled by the iMU and/or OMC.		

AlarmWiring



NOTE: THE 3 DIGIT NUMBERS ARE THE ALARM CODES (SENT TO THE OMC).

Figure 3-5 ***Punch block 2 - iMU pinouts***

Punch block 2 – alarm connections

The iMU connector and pin label information refers to the connectors on the iMU itself. Only the alarm code number is passed to the OMC. Table 3-8 shows those alarms that connect from the User Alarm/Control connector on the back of the iMU to punch block 2.

Table 3-8 ***Punch block 2 pin-outs***

Alarm code	Punch block pairs	iMU standard alarm connection
201	6, 31	customer defined input
202	5, 30	customer defined input
203	14, 39	customer defined input
204	13, 38	customer defined input
205	12, 37	customer defined input
206	11, 36	customer defined input
207	10, 35	customer defined input
208	9, 34	customer defined input
209	8, 33	customer defined input
211	7, 32	customer defined input
212	22, 47	customer defined input
213	21, 46	customer defined input
214	20, 45	customer defined input
215	19, 44	customer defined input
216	18, 43	customer defined input
217	17, 42	customer defined input
218	16, 41	customer defined input
252	15, 40	customer defined input
255*	26, 2, 1	customer defined output
256*	28, 4, 3	customer defined output
* These alarms are outputs controlled by the iMU and/or OMC.		

Recommended Tools, Equipment, and Parts

Table 3-9 through Table 3-11 list the tools, test equipment and locally procured parts that are required for the installation procedure. The model numbers listed are recommended, but equivalent tools and equipment made by other manufacturers are acceptable.

When selecting tools and equipment, always choose those which have insulated grips and handles. This helps prevent potential injury resulting from electrical shock.

Recommended tools

Table 3-9 lists the recommended tools for installation. These are not included as part of the iSC shipment and must be procured locally. All model numbers are Motorola part numbers, unless noted otherwise.

Table 3-9 ***Recommended tools for installation***

Tool	Model/type	Supplier	Purpose
banding cutter	n/a	locally procured	n/a
cable crimp tool	TBM5 S	Thomas & Betts	crimping lugs on power cables
calculator	n/a	locally procured	n/a
cart, two-wheeled (luggage type)	6680387A47	Motorola	transportation of tools and test equipment
circuit cooler spray	0180334B46	Motorola	low temperature alarm testing
cellular tool kit	RPX4286A	Motorola	miscellaneous tools
crimping tool	8-pin modular cable	locally procured	customizing T1 connections
digital level	24” w/module	Pro Smartlevel	antenna downtilt measurements

Recommended Tools, Equipment, and Parts

Table 3-9 ***Recommended tools for installation — continued***

Tool	Model/type	Supplier	Purpose
driver tools	2" hex to hex extension (2)	locally procured	n/a
	6" hex to hex extension (2)		n/a
	T10 TORX bit (APEX)		n/a
	Long T10 TORX bit		n/a
	T15 TORX bit (APEX)		n/a
	T20 TORX bit (APEX)		n/a
	T25 TORX bit (APEX)		n/a
	T30 TORX bit (APEX)		n/a
electric drill	0180371B44	Motorola	drilling holes
electric screwdriver (only 1 required)	RLN4053A/ heavy duty	Motorola	tightening screws/ nuts
	RLN4051A/ heavy duty (variable speed)	Motorola	tightening screws/ nuts
	0180320B28/ light duty	Motorola	tightening screws/ nuts
flashlight, small	n/a	locally procured	n/a
hammer drill	RLN4315A	Motorola	drilling concrete floor for mounting studs
heat gun	0180320B51	Motorola	high temperature alarm testing
hole punch	1"	locally procured	wiring 240 VAC to power supply cabinet
ISO T BNC	n/a	locally procured	tower top amp sensitivity testing

Table 3-9 ***Recommended tools for installation — continued***

Tool	Model/type	Supplier	Purpose
knife, utility	n/a	locally procured	n/a
markers (2)	n/a	locally procured	n/a
nut driver, 3/16”	n/a	locally procured	n/a
nut driver, 10 mm	n/a	locally procured	n/a
pliers	n/a	locally procured	n/a
pliers, connector	n/a	Snap-on	n/a
pliers, needle nose	n/a	locally procured	n/a
screw driver, torque hand tool	5 in-lbs	Ind Pneumatic	n/a
drives for torque screw driver	1/4” drive, 7/16” deep socket	Ind Pneumatic	n/a
	1/4” drive, 5/16” deep socket		n/a
	1/4” drive, 3/16” socket		n/a
	1/4” drive, 1” blade screwdriver		n/a
	1/4” hex to 1/4” hex drive		n/a
screw drivers	#0 Phillips	locally procured	n/a
	#2 Phillips		n/a
	3/16” blade		n/a
	#1 blade		n/a
	1/4” blade		n/a
step ladder	7’	locally procured	to gain access to cable tray assembly
tarpaulin	approximately 8’ x 10’	locally procured	protect equipment during installation

Recommended Tools, Equipment, and Parts

Table 3-9 ***Recommended tools for installation — continued***

Tool	Model/type	Supplier	Purpose
tie wrap gun	n/a	locally procured	n/a
tool box	n/a	locally procured	n/a
torque wrenches	6680388A27	Motorola	tightening battery lug nuts
	5/16” breaking type, 5 in-lbs	locally procured	for SMA connectors
drives for 5/16” torque wrench	6” extension, 3/8” drive	Snap-on	n/a
	1” deep 6 point socket, 3/8” drive		n/a
	5/8” deep socket, 3/8” drive	Ind Pneumatic	n/a
	9/16” deep socket, 3/8” drive		n/a
	1” deep socket, 3/8” drive		n/a
	1/4” hex to 3/8” hex drive		n/a
TORX driver with bits (handle storage)	n/a	locally procured	n/a
tweezers	n/a	locally procured	n/a
vacuum cleaner	0180382A11	Motorola	general clean-up
wire cutters	n/a	locally procured	cutting power cables (#6 AWG to 250 MCM)
wrenches, open end	3/8”	locally procured	n/a
	1-1/16”		n/a
wrist strap	n/a	locally procured	n/a

Recommended test equipment

Table 3-10 lists the recommended test equipment for installation. These are not included as part of the system shipment and must be procured locally. All model numbers are Motorola part numbers, unless noted otherwise.

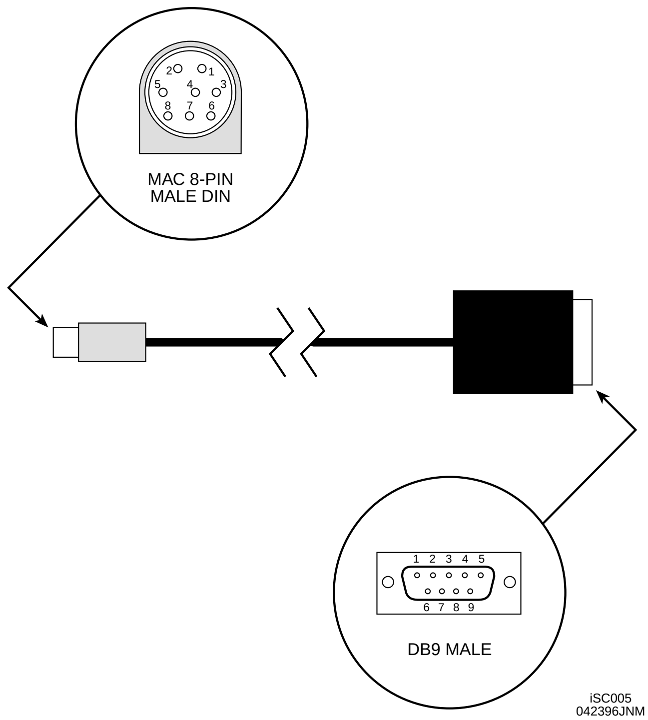
Table 3-10 ***Recommended test equipment for installation***

Test Equipment	Model/Type	Supplier	Purpose
communication software	Procomm Plus (or equivalent)	DataStorm	host communication
digital multimeter (only 1 required)	Fluke 77	Fluke	DC measurements
	R1037A	Motorola	DC measurements
	R1073A	Motorola	DC measurements
file compression software	PKUnzip	PKWare	compress/ decompress large files
ground resistance ohmmeter	AEMC 3700 clamp-on ground tester	locally procured	measure for adequate ground
RF attenuators	refer to the Parts and Suppliers appendix		protection for R2660 and used with the equipment for RF attenuation
service computer	refer to the Systems Testing chapter		local service terminal
communication cable between PC service computer and the equipment	n/a	n/a	DB9 male / RS232 male used with RS232 female / DB9 male. Pinouts from DB9 to DB9 must be straight through
communication cable between Macintosh® service computer and the equipment	n/a	n/a	Din 8 male / DB9 male
service monitor	R2660 w/ iDEN	Motorola	station alignment

Recommended Tools, Equipment, and Parts

Table 3-10 ***Recommended test equipment for installation — continued***

Test Equipment	Model/Type	Supplier	Purpose
test cable used with R2660	n/a	n/a	12’ of typhlon cable type N male both ends
T1 tester/protocol analyzer	209A T	T-Berd	testing T1 lines



DB9 Male Connector	DIN 8 Connector
4	1
1,6	2
3	3
5	4
2	5
–	6
–	7
5	8

Figure 3-6 ***MAC 8-pin male DIN to DB9 male connector***

Recommended parts

Table 3-11 lists the recommended parts for installation. These are not included as part of the system shipment and must be procured locally. All model numbers are Motorola part numbers, unless noted otherwise.

Table 3-11 ***Recommended parts for installation***

Part	Type/size	Supplier	Where used
anchor kit	#02100-13	Hendry	cabinet floor anchors
bolts	3/8x16x3/4”	locally procured	Breaker Panel on Power Supply Rack
	1/4x20x1/2”	locally procured	DC return bus, Power Supply Rack
colored vinyl tape	red, black, green, brown, yellow, and white	locally procured	wire identification
grease	anti-oxidant	locally procured	battery terminal corrosion control
lockwashers	split - 3/8”	locally procured	Breaker Panel, Power Supply Rack
	split - 1/4”	locally procured	DC return bus, Power Supply Rack
lugs	2 hole 1” center various sizes	locally procured	battery connection; 3/8” bolt, 4/0 Cu
lugs	2 hole 1” center	locally procured	DC return connection; 1/4” bolt, #6 Cu
power cables	#6 AWG stranded Cu (red and black)	locally procured	Power Supply wiring
	4/0 stranded Cu (red and black)	locally procured	Power Supply wiring
ground cables	#2 AWG stranded Cu (green)	locally procured	cabinet grounding
	#6 AWG stranded Cu (green)	locally procured	cabinet grounding
NOTE: Refer to the Parts and Suppliers appendix for other cable sizes needed where equipment cabinets are not next to each other.			

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Installation

Chapter overview

This chapter provides procedures required to permanently install the system into the selected site. The chapter topics are listed in the following table.

Section	Page	This section . . .
Installation Overview	4-2	provides general information for the installation procedures
Cabinet Installation	4-3	defines the methods for installing wheeled and non-wheeled equipment cabinets
Intercabling Connections	4-8	provides step-by-step instructions for connecting power, ground, timing, Ethernet, alarm, T1/E1, and antenna connections

Installation Overview

The procedures described in this chapter assume the field technician or installer has knowledge of the installation techniques contained in the *Quality Standards Fixed Network Equipment - Installation Manual (R56)*.

Note: Prior to performing the installation procedures, prepare the site with all associated antennas, phone lines, and other related site equipment. This information is covered in the Pre-Installation chapter.

The iSC and several RF Cabinets may be installed, depending on the configuration.

Cell/sector sites

Two terms are used interchangeably when discussing site configurations: cell and sector sites.

- Sector is commonly used when discussing antenna radiation patterns.
- Cell is commonly used when discussing configuration files.

In an iDEN system, the two are synonymous. Some sites may be configured with one, two, or three sectors (cells). In this chapter, the term sector is used.

Single sector sites usually provide omni-directional RF coverage and are referred to as omni sites. Two or three sectored sites have different coverage patterns for the sectors and are referred to as sector sites. Each site requires an iSC.

In a typical site, the term cabinet is a generic term used to refer to Fixed Network Equipment (FNE) mounted in different types of frames. It does not refer in any way to building electrical cabinets, outdoor utility cabinets, or some types of equipment shelters commonly known as cabinets.

The iSC can be shipped in one of two ways: compatible with Schroff Eurorack or EIA 23” power rack.

Cabinet Installation

This section provides installation instructions for cabinets already containing iSCs and provides procedures for permanently mounting the equipment cabinets within a site. This section contains the following sections.

Section	Page	This section . . .
Cabinet bracing considerations	4-3	describes considerations for properly bracing cabinets
Cabling considerations	4-4	describes considerations for intercabling between cabinets
Access considerations	4-4	describes considerations for access to cabinets during servicing
Cabinet position considerations	4-5	describes considerations and mounting procedures for cabinets

Note: This section does not refer to the Power Supply Rack or battery rack. Refer to the manufacturer’s installation manual for information relating to these cabinets.

Cabinet bracing considerations

Installation for each type of cabinet is slightly different. The cabinets are self-supporting structures. The cabinets require additional bracing during shipment of prefabricated sites.

In seismically active areas, additional bracing of the cabinet may be required to prevent it from tipping. However, the bracing hardware must be locally procured. There are no specific procedures within this manual for bracing cabinets in active seismic areas.

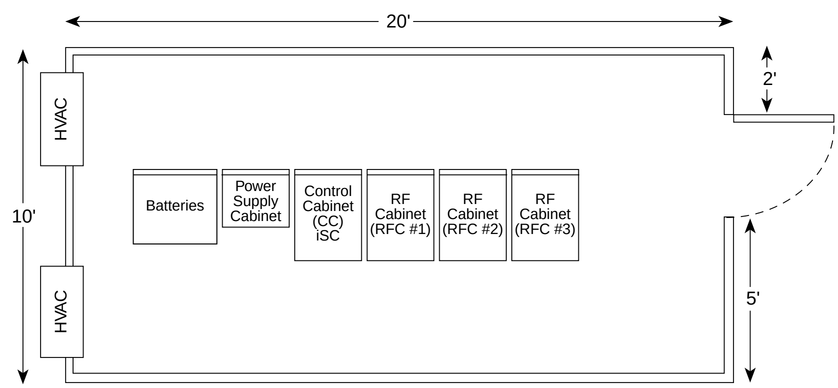
! WARNING !

Always use two or more persons whenever moving a cabinet. A fully configured equipment cabinet weighs approximately 800 lbs (360 kg).

Cabling considerations

Intercabinet cables used in the installation are manufactured at a predetermined length. The length of the cables restrict the height of the site cable tray to no more than 6” above the cabinets. This also restricts the spacing between cabinets to no more than 5”.

The intercabling requires a cabinet layout configuration similar to Figure 4-1. If the site cannot accommodate this layout, the intercabinet cables shipped with the system may not be long enough. Custom site fabricated cables may need to be manufactured.



NOTES:

1. Double lines on above units indicate front of equipment.
2. iSC can exist in its own cabinet, in the Power Supply or RF Cabinets, or in an SRRC or SRSC.

iSC006
031999JNM

Figure 4-1 ***Typical Cabinet layout***

Access considerations

Allow at least 2’ of floor space in front and behind the cabinets to permit access during installation. Although most maintenance is performed from the front of the equipment cabinets, access to the rear is required for expansion, cabling, and antenna connections.

Cabinet position considerations

Sector identification

Refer to the *EBTS System Manual (68P81099E10)* for details on sector identification.

Cabinet Installation Instructions

The following procedures describe how to mount non-wheeled cabinets in a system site building. Be sure to read all of the procedures carefully to ensure a quality installation.

Cabinets must be secured to the floor for optimum stability. Since the cabinets are very heavy, this procedure is written so that each cabinet is moved only once.

Motorola recommends installing the first cabinet at the far end of the row, and then installing adjacent cabinets until the row is completed.

Perform the following steps to properly install the cabinets within the site building:

1. Measure the mounting location for the first cabinet in the row.

2. Carefully mark the mounting holes with a pencil, as indicated on the appropriate cabinet footprint.

3. Drill the marked mounting holes to the appropriate depth of the mounting hardware with a hammer drill and bit.

   Refer to the Parts and Suppliers appendix for recommended mounting hardware.

4. Insert an anchor into the drilled hole.

   If necessary, tap the anchor into place using a hammer.

5. Remove the four screws securing the bottom kick panel to the front and back of the cabinet.

   Remove the kick panel and set aside during installation.

! WARNING !

Always use two or more persons whenever moving a cabinet. A fully configured equipment cabinet weighs approximately 800 lbs (360 kg).

6. Carefully move the cabinet into the position indicated by the holes in the floor.

   Adjust and level the cabinet as necessary to align the cabinet mounting holes with the pre-drilled holes in the floor.

7. Secure the cabinet to the site floor with the locally procured mounting hardware.

8. If required, connect adjacent cabinets to each other using the ganging hardware (kit no. 0182098V01).

Intercabling Connections

This section describes the cabling procedures for each of the intercabinet connections.

For Single Rack, Redundant Controller GEN 4 EBTS, refer to the SRSC GEN 4 EBTS section of the *EBTS System Manual (6881099E10)*. For Single Rack, Single Controller GEN 4 EBTS, refer to the SRSC GEN 4 EBTS section of the *EBTS System Manual (6881099E10)*.

Junction Panels

Most of the intercabling is accomplished on the Junction Panel located at the top-rear of the equipment cabinet. Figure 4-2 shows the Junction Panel.

The Junction Panel is accessed from the rear of the cabinet. All intercabinet cabling runs up and out the top of each cabinet into the cable tray assembly. The OUT connection for each cable has been connected by the factory. Installation of intercabinet cabling is completed by connecting the free end of each cable into the appropriate IN connector of adjacent cabinets.

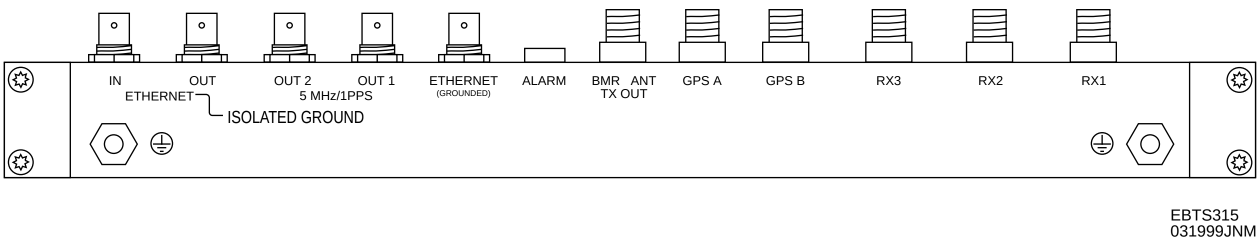


Figure 4-2 ***iSC Junction Panel (rear view)***

Cavity Combining RFDS intercabinet cabling

Intercabling between the Control Cabinet and the RF Cabinets for systems equipped with Cavity Combining RF Distribution Systems is listed below. Choose the appropriate table below, then refer to the appropriate instructions for connecting the required intercabling.

1-5 Channel Omni Site Cables

Table 4-1 lists the required cables for an omni site (single sector).

Table 4-1 ***1-5 Channel Omni Site Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	iSC to RF Cabinet #1
0112004Z29	5 MHz/1 PPS	1	iSC to RF Cabinet #1
3084225N42	Alarms	1	iMU to RF Cabinet #1
3082070X01	PCCH Redundancy	1	iSC to RF Cabinet #1

6-10 Channel Cavity Omni Site Cables

Table 4-2 lists the required cables for a 6-10 channel cavity omni site.

Table 4-2 ***6-10 Channel Cavity Omni Site Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	iSC to Main RF Cabinet
0112004Z29	Ethernet	1	Main RF Cabinet to Expansion RF Cabinet
0112004Z29	5 MHz/1 PPS	1	iSC to Main RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Main RF Cabinet to Expansion RF Cabinet
3084225N42	Alarms	1	Control Cabinet to Main RF Cabinet
3084225N42	Alarms	1	Control Cabinet to Expansion RF Cabinet
0182004W04	Phasing Harness	1	Main RF Cabinet/Expansion RF Cabinet
0112004B24	Receive Expansion Cabling	3	Main RF Cabinet to Expansion RF Cabinet

11-15 Channel Cavity Omni Site Cables

Table 4-3 lists the required cables for an 11-15 channel cavity omni site.

Table 4-3 ***11-15 Channel Cavity Omni Site Intercabling***

Cable PN	Description	Qty.	Connections
0112004Z29	Ethernet	3	iSC to Main RF Cabinet
			Main RF Cabinet to Expansion RF Cabinet #1
			Expansion RF Cabinet #1 to Expansion RF Cabinet #2
0112004Z29	5 MHz/1 PPS	3	iSC to Main RF Cabinet
			Main RF Cabinet to Expansion RF Cabinet #1
			Expansion RF Cabinet #1 to Expansion RF Cabinet #2
3084225N42	Alarms	3	Control Cabinet to Main RF Cabinet
			Control Cabinet to Expansion RF Cabinet #1
			Control Cabinet to Expansion RF Cabinet #2
0182004W04	Phasing Harness	1	Main RF Cabinet/Expansion RF Cabinet #1
0112004B24	Receive Expansion Cables	6	Main RF Cabinet to Expansion RF Cabinet

16-20 Channel Cavity Omni Site Cables

Table 4-4 lists the required cables for a 16-20 channel cavity omni site.

Table 4-4 ***16-20 Channel Cavity Omni Site Intercabling***

Cable PN	Description	Qty.	Connections
0112004Z29	Ethernet	4	iSC to Main RF Cabinet
			Main RF Cabinet to Expansion RF Cabinet #1
			Expansion RF Cabinet #1 to Expansion RF Cabinet #2
			Expansion RF Cabinet #2 to Expansion RF Cabinet #3
0112004Z29	5 MHz/1 PPS	4	iSC to Main RF Cabinet
			Main RF Cabinet to Expansion RF Cabinet #1
			Expansion RF Cabinet #1 to Expansion RF Cabinet #2
			Expansion RF Cabinet #2 to Expansion RF Cabinet #3
3084225N42	Alarms	4	Control Cabinet to Main RF Cabinet
			Control Cabinet to Expansion RF Cabinet #1
			Control Cabinet to Expansion RF Cabinet #2
			Control Cabinet to Expansion RF Cabinet #3
0182004W04	Phasing Harness	2	Main RF Cabinet/Expansion RF Cabinet #1
			Expansion RF Cabinet #2/Expansion RF Cabinet #3
0112004B24	Receive Expansion Cables	9	Main RF Cabinet to Expansion RF Cabinets

Sectored site cables

Table 4-5 lists the required cables for a three sectored site.

Table 4-5 ***Sectored Site Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	iSC to RF Cabinet #1
0112004Z29	Ethernet	1	RF Cabinet #1 to RF Cabinet #2
0112004Z29	Ethernet	1	RF Cabinet #2 to RF Cabinet #3
0112004Z29	5 MHz/1 PPS	1	iSC to RF Cabinet #1
0112004Z29	5 MHz/1 PPS	1	RF Cabinet #1 to RF Cabinet #2
0112004Z29	5 MHz/1 PPS	1	RF Cabinet #2 to RF Cabinet #3
3084225N42	Alarms	1	iMU to RF Cabinet #1
3084225N42	Alarms	1	iMU to RF Cabinet #2
3084225N42	Alarms	1	iMU to RF Cabinet #3
3082070X01	PCCH Redundancy	1	iSC to RF Cabinet #1 iSC to RF Cabinet # 2 iSC to RF Cabinet #3

800 MHz Duplexed RFDS intercabinet cabling

Intercabling between the Control Cabinet and the RF Cabinets for systems equipped with Duplexed RF Distribution Systems is listed below. Choose the appropriate table below, then refer to the appropriate instructions for connecting the required intercabling.

1-4 Channel Omni Site Cables

Table 4-6 lists the required cables for an omni site (single sector).

Table 4-6 ***1-4 Channel Omni Site Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	iSC to RF Cabinet #1
0112004Z29	5 MHz/1 PPS	1	iSC to RF Cabinet #1
3084225N42	Alarms	1	iMU to RF Cabinet #1

Sectored Site Cables

Table 4-7 lists the required cables for a three-sectored site.

Table 4-7 ***Sectored Site Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	iSC to RF Cabinet #1
0112004Z29	Ethernet	1	RF Cabinet #1 to RF Cabinet #2
0112004Z29	Ethernet	1	RF Cabinet #2 to RF Cabinet #3
0112004Z29	5 MHz/1 PPS	1	iSC to RF Cabinet #1
0112004Z29	5 MHz/1 PPS	1	RF Cabinet #1 to RF Cabinet #2
0112004Z29	5 MHz/1 PPS	1	RF Cabinet #2 to RF Cabinet #3
3084225N42	Alarms	1	iMU to RF Cabinet #1
3084225N42	Alarms	1	iMU to RF Cabinet #2
3084225N42	Alarms	1	iMU to RF Cabinet #3

800 MHz Duplex Hybrid Expansion RFDS intercabinet cabling

Intercabling between the Control Cabinet and the RF Cabinets for systems equipped with Duplex Hybrid Expansion RF Distribution Systems is listed below. Choose the appropriate table below, then refer to the appropriate instructions for connecting the required intercabling.

5-8 Channel Duplex Hybrid Expansion Site Cables

Table 4-8 lists the required cables for a 5-8 channel duplex hybrid expansion site.

Table 4-8 ***5-8 Channel Duplex Hybrid Expansion Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	iSC to Main RF Cabinet
0112004Z29	Ethernet	1	Main RF Cabinet to Expansion RF Cabinet
0112004Z29	5 MHz/1 PPS	1	iSC to Main RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Main RF Cabinet to Expansion RF Cabinet
3084225N42	Alarms	1	iSC to Main RF Cabinet
3084225N42	Alarms	1	iSC to Expansion RF Cabinet

9-12 Channel Duplex Hybrid Expansion Site Cables

Table 4-9 lists the required cables for a 9-12 channel duplex hybrid expansion site.

Table 4-9 ***9-12 Channel Duplex Hybrid Expansion Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	iSC to Main RF Cabinet
0112004Z29	Ethernet	1	Main RF Cabinet to Expansion RF Cabinet #1
0112004Z29	Ethernet	1	Expansion RF Cabinet #1 to Expansion RF Cabinet #2
0112004Z29	5 MHz/1 PPS	1	iSC to Main RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Main RF Cabinet to Expansion RF Cabinet #1
0112004Z29	5 MHz/1 PPS	1	Expansion RF Cabinet #1 to Expansion RF Cabinet #2
3084225N42	Alarms	1	iMU to Main RF Cabinet
3084225N42	Alarms	1	iMU to Expansion RF Cabinet #1
3084225N42	Alarms	1	iMU to Expansion RF Cabinet #2

800 MHz GEN 4 Duplexed RFDS and 900 MHz Duplexed RFDS intercabinet cabling

Intercabling between the Control Cabinet and the RF Cabinets for systems equipped with 900 MHz Duplexed or 800 MHz GEN 4 RF Distribution Systems is listed below. Choose the appropriate table below, then refer to the appropriate instructions for connecting the required intercabling.

1-6 Channel GEN 4 or 900 MHz RFDS Site Cables

Table 4-10 lists the required cables for a 1-6 channel GEN 4 or 900 MHz RFDS site.

Table 4-10 ***1-6 Channel 800 MHz GEN 4 / 900 MHz RFDS Site Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	iSC to Main RF Cabinet
0112004Z29	Ethernet	1	Main RF Cabinet to Expansion RF Cabinet
0112004Z29	5 MHz/1 PPS	1	iSC to Main RF Cabinet
3084225N42	Alarms	1	iSC to Main RF Cabinet

7-12 Channel GEN 4 or 900 MHz RFDS Expansion Site Cables

Table 4-11 lists the required cables for a 7-12 channel GEN 4 or 900 MHz RFDS expansion site.

Table 4-11 ***7-12 Channel 800 MHz GEN 4 / 900 MHz RFDS Expansion Site Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	iSC to Main RF Cabinet
0112004Z29	Ethernet	1	Main RF Cabinet to Expansion RF Cabinet
0112004Z29	5 MHz/1 PPS	1	iSC to Main RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Main RF Cabinet to Expansion RF Cabinet
3084225N42	Alarms	1	iMU to Main RF Cabinet
3084225N42	Alarms	1	iMU to Expansion RF Cabinet

13-18 Channel 800 MHz GEN 4 RFDS Expansion Site Cables

Table 4-12 lists the required cables for a 13-18 channel GEN 4 RFDS expansion site.

Table 4-12 ***13-18 Channel 800 MHz GEN 4 RFDS Expansion Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	iSC to Main RF Cabinet
0112004Z29	Ethernet	1	Main RF Cabinet to Expansion RF Cabinet #1
0112004Z29	Ethernet	1	Expansion RF Cabinet #1 to Expansion RF Cabinet #2
0112004Z29	5 MHz/1 PPS	1	iSC to Main RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Main RF Cabinet to Expansion RF Cabinet #1
0112004Z29	5 MHz/1 PPS	1	Expansion RF Cabinet #1 to Expansion RF Cabinet #2
3084225N42	Alarms	1	iMU to Main RF Cabinet
3084225N42	Alarms	1	iMU to Expansion RF Cabinet #1
3084225N42	Alarms	1	iMU to Expansion RF Cabinet #2
0112004B24	Receive Expansion Cables	3	Main RF Cabinet to Expansion RF Cabinet

19/20 Channel 800 MHz GEN 4 RFDS Expansion Site Cables

Table 4-13 lists the required cables for a 19/20 channel GEN 4 RFDS expansion site.

Table 4-13 ***19/20 Channel 800 MHz GEN 4 RFDS Expansion Intercabling***

Cable PN	Description	Qty.	Connection
0112004Z29	Ethernet	1	iSC to Main RF Cabinet
0112004Z29	Ethernet	1	Main RF Cabinet to Expansion RF Cabinet #1
0112004Z29	Ethernet	1	Expansion RF Cabinet #1 to Expansion RF Cabinet #2
0112004Z29	Ethernet	1	Expansion RF Cabinet #2 to Expansion RF Cabinet #3
0112004Z29	5 MHz/1 PPS	1	iSC to Main RF Cabinet
0112004Z29	5 MHz/1 PPS	1	Main RF Cabinet to Expansion RF Cabinet #1
0112004Z29	5 MHz/1 PPS	1	Expansion RF Cabinet #1 to Expansion RF Cabinet #2
0112004Z29	5 MHz/1 PPS	1	Expansion RF Cabinet #2 to Expansion RF Cabinet #3
3084225N42	Alarms	1	iMU to Main RF Cabinet
3084225N42	Alarms	1	iMU to Expansion RF Cabinet #1
3084225N42	Alarms	1	iMU to Expansion RF Cabinet #2
3084225N42	Alarms	1	iMU to Expansion RF Cabinet #3
0112004B24	Receive Expansion Cables	6	Main RF Cabinet to Expansion RF Cabinets

5 MHz/1 PPS intercabling

CAUTION

A powered-down BR connected to the 5 MHz/1 PPS system can degrade the 5 MHz/1 PPS signal for the other BRs, possibly causing malfunctions.

Before powering-down a BR, always first disconnect the BR from the 5 MHz/1 PPS system. Make certain powered-down BRs are not connected to the 5 MHz/1 PPS system. (5 MHz/1 PPS "T" connections at a powered-down BR can be left open; termination at these points is not required.)

5 MHz/1 PPS intercabling is the 5 MHz/1 PPS cabling from the cabinet containing the iSC to the RF Cabinet(s). Figures 4-3 through 4-7 show the required intercabling for various EBTS site configurations. Table 4-14 correlates the specific types of systems and sites to Figures 4-3 through 4-7.

Intercabinet Connections (Sites with 15 Channels or less)

The 5 MHz/1 PPS signal originates in the Site Reference ISA (SRI) card located in the iSC. All 5 MHz/1 PPS connections between the iSC and the RF Cabinet(s) are made on the Junction Panel of the iSC Control and RF Cabinets.

Intercabinet Connections (Sites with more than 15 Channels)

The SRI card has two identical buffered outputs available at connectors **OUT 1** and **OUT 2**. The SRI **OUT 2** connector is branched out of the cabinet containing the iSC using the junction panel connection labeled "**OUT 2**".

The **OUT 1** and **OUT 2** connectors should be utilized in a manner that distributes the BR load evenly between the two outputs.

To properly distribute the BR load and ensure site reliability in the event of a failure, follow the general guidelines specified below:

- Distribute the load as evenly as possible between the two SRI output connectors.
- As with all 5 MHz/1 PPS cabling, the far-end of each daisy-chain must be terminated with the specified 50Ω load.
- In sectored sites with multiple RF Cabinets serving a single sector, do not drive all cabinets within a single sector from the same SRI output.

The following examples illustrate possible RF Cabinet 5 MHz/1 PPS intercabling that balances the BR load and provides SRI output redundancy within a sector.

Example 1 — Assume a 24-BR, three-sector site consisting of the following arrangement:

- 12 BRs in Sector 1
- 8 BRs in Sector 2
- 4 BRs in Sector 3

The table below shows a proper distribution of the SRI outputs to the RF Cabinets (RFCs).

SRI Output	Sector 1 (12 BRs)	Sector 2 (8 BRs)	Sector 3 (4 BRs)
OUT 1	RFC 1 (4 BRs) RFC 2 (4 BRs)	RFC 4 (4 BRs)	
OUT 2	RFC 3 (4 BRs)	RFC 5 (4 BRs)	RFC 6 (4 BRs)

Note that in the above example, each SRI output drives 12 BRs, while utilizing both SRI outputs within sectors 1 and 2.

Example 2 — Assume a 16-BR, two-sector site with the following arrangement:

- 8 BRs in Sector 1
- 8 BRs in Sector 2

The table below shows a proper distribution of the SRI outputs to the RFCs.

SRI Output	Sector 1 (8 BRs)	Sector 2 (8 BRs)
OUT 1	RFC 1 (4 BRs)	RFC 3 (4 BRs)
OUT 2	RFC 2 (4 BRs)	RFC 4 (4 BRs)

Note that in the above example, each SRI output drives eight BRs, while utilizing both SRI outputs within a given sector.

Example 3 — Assume a 20-BR omni site with four RFCs, each containing five BRs. The table below shows a proper distribution of the SRI outputs to the RFCs.

SRI Output	Omni 20
OUT 1	RFC 1 (5 BRs) RFC 2 (5 BRs)
OUT 2	RFC 3 (5 BRs) RFC 4 (5 BRs)

- Note that in the above example, each SRI output drives 10 BRs.

5 MHz/1 PPS Cabling Procedure

Noting the general guidelines discussed above, perform 5 MHz/1 PPS cabling between cabinets as follows:

1. On the cabinet that contains the iSC, connect cable (PN 0112004Z29) to the **5 MHz/1 PPS OUT 1** connector on the Junction Panel. For sites with more than 15 channels, connect an additional cable (PN 0112004Z29) to the **5 MHz/1 PPS OUT 2** connector on the Junction Panel.

   Connect free end of cable(s) to **5 MHz/1 PPS IN** connector on RF Cabinet(s).

2. Starting at the first RF Cabinet, daisy-chain connect cables (PN 0112004Z29) from the **5 MHz/1 PPS OUT** connectors to the **5 MHz/1 PPS IN** connectors on each cabinet Junction Panel in accordance with Table 4-14 and Figures 4-3 through 4-7, as applicable.

3. Connect a 50 Ω BNC Terminator (PN 0909906D01) to the **5 MHz/1 PPS OUT** connector on the last RF Cabinet of each daisy-chain in the configuration. (Systems using **both** the OUT 1 and OUT 2 SRI outputs will have **two** 50Ω end terminations.)

4. Proceed to Ethernet intercabling.

Table 4-14 ***5 MHz/1 PPS intercabling***

System/Site Type	RF Cabinet Configuration	Perform Cabling As Shown In:
DUPLEXED RFDS		
1-5 Channel Omni	1 Main RF Cabinet	Figure 4-3
5-8 Channel Duplex Hybrid Expansion	1 Main RF Cabinet 1 Expansion RF Cabinet	Figure 4-4
9-12 Channel Duplex Hybrid Expansion	1 Main RF Cabinet 2 Expansion RF Cabinets	Figure 4-5
Sectored	3 Main RF Cabinets	Figure 4-7
CAVITY COMBINING RFDS		
1-5 Channel Omni	1 Main RF Cabinet	Figure 4-3
6-10 Channel Omni Expansion	1 Main RF Cabinet 1 Expansion RF Cabinet	Figure 4-4
11-15 Channel Omni Expansion	1 Main RF Cabinet 2 Expansion RF Cabinets	Figure 4-5
16-20 Channel Omni Expansion*	1 Main RF Cabinet 3 Expansion RF Cabinets	Figure 4-6
Sectored	3 Main RF Cabinets	Figure 4-7
800 MHz GEN 4 / 900 MHz RFDS		
1-6 Channel Omni	1 Main RF Cabinet	Figure 4-3
7-12 Channel Omni Expansion	1 Main RF Cabinet 1 Expansion RF Cabinet	Figure 4-4
13-20 Channel Omni Expansion*	1 Main RF Cabinet 2 Expansion RF Cabinets	Figure 4-6
* Systems using more than 15 channels require High-Capacity iSC utilizing dual SRI outputs OUT1 and OUT2.		

Intercabling Connections

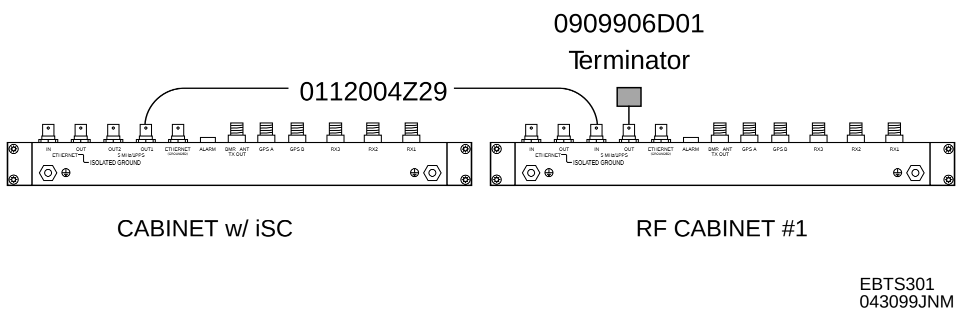


Figure 4-3 ***5 MHZ/1 PPS Connections for Single RF Cabinet Omni Sites***

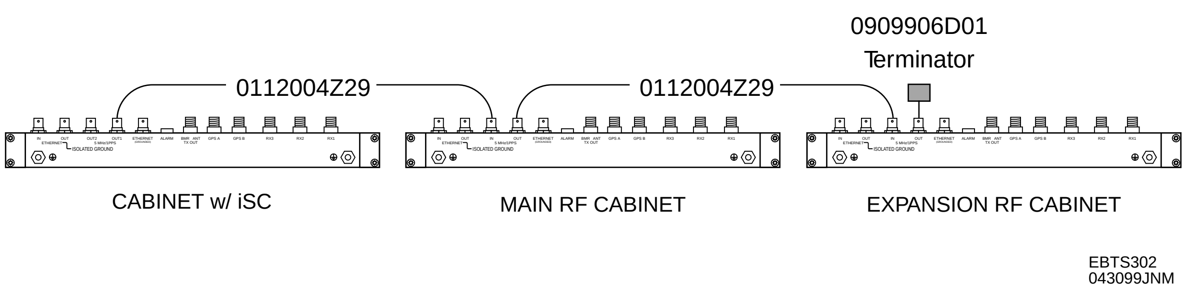


Figure 4-4 ***5 MHz/ 1PPS Connections for 2 RF Cabinet Omni Expansion Sites***

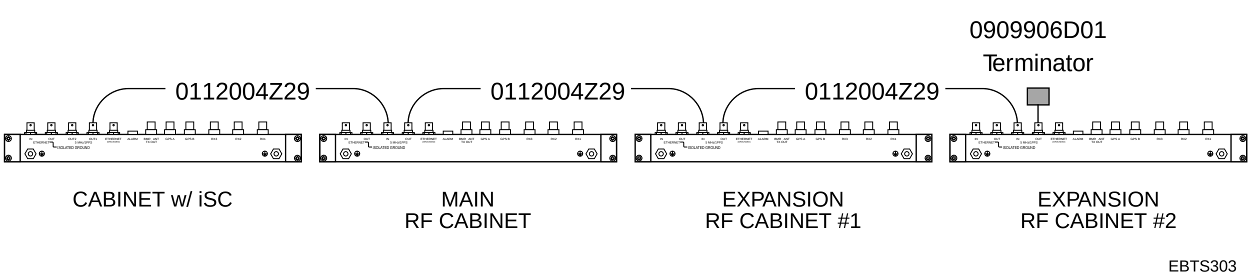


Figure 4-5 ***5 MHz/1 PPS Connections for 3 RF Cabinet Omni Expansion Sites***

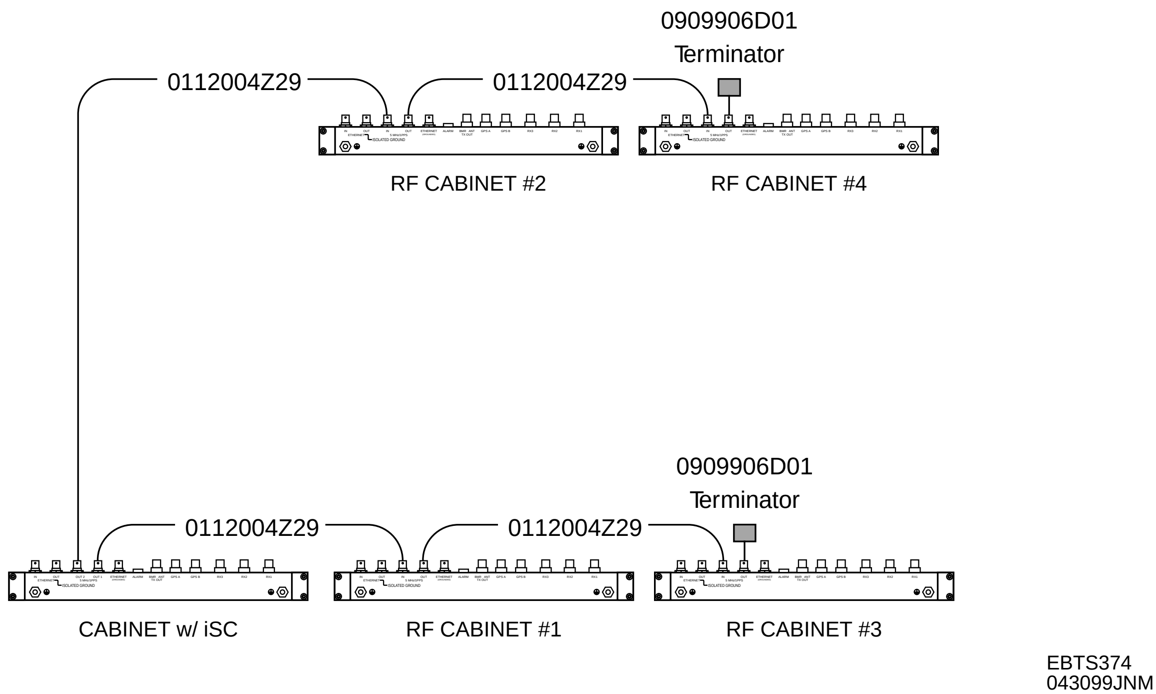


Figure 4-6 ***5 MHz/ 1PPS Connections for Omni Sites Using More Than 15 Channels***

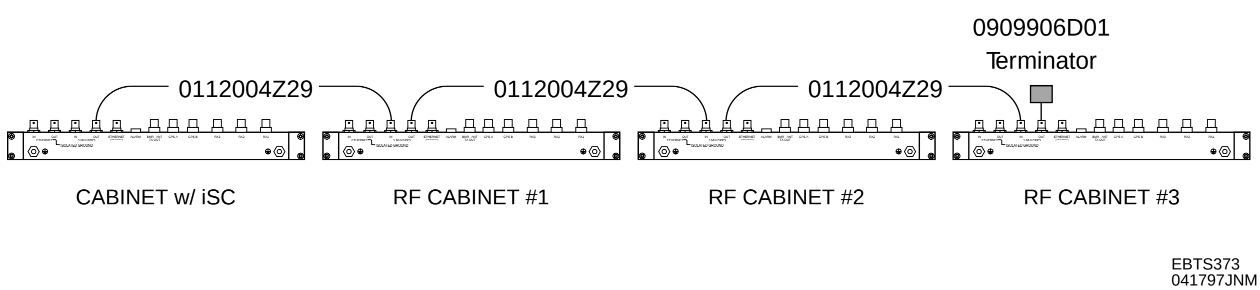


Figure 4-7 ***5 MHz/1 PPS Connections for Sectored Sites***

Intercabling Connections

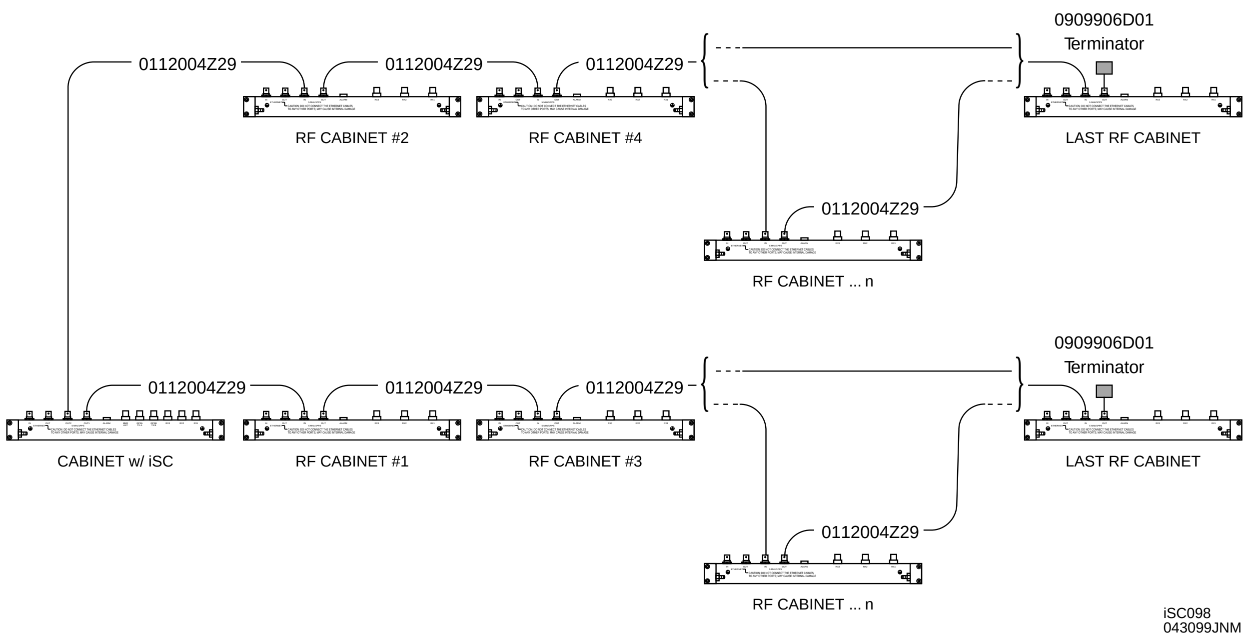


Figure 4-8 ***5 MHz/1 PPS connections***

Ethernet intercabling

All Ethernet connections are made on the Junction Panels of the cabinets. The connections are labeled ETHERNET IN and ETHERNET OUT. Figures 4-9 through 4-12 show the required intercabling for various EBTS site configurations. Table 4-15 correlates the specific types of systems and sites to Figures 4-9 through 4-12.

Ethernet Cabling Procedure

Perform Ethernet cabling between cabinets as follows:

1. On the cabinet containing the iSC, locate the free end of the cable (PN 0112004Z29) connected to the **ETHERNET (GROUNDED)** connector on the junction panel.

   Connect free end of cable to **ETHERNET IN** connector on RF Cabinet(s).

2. Starting at the first RF Cabinet, daisy-chain connect cables (PN 0112004Z29) from the **ETHERNET OUT** connectors to the **ETHERNET IN** connectors on each cabinet Junction Panel in accordance with Table 4-15 and Figures 4-9 through 4-12, as applicable.

3. Connect a 50Ω BNC Termination (PN 0909906D01) to the **ETHERNET OUT** connector on the last RF Cabinet in the configuration.

4. Proceed to Alarm intercabling.

Intercabling Connections

Table 4-15 ***Ethernet intercabling***

System/Site Type	RF Cabinet Configuration	Perform Cabling As Shown In:
DUPLEXED RFDS		
1-5 Channel Omni	1 Main RF Cabinet	Figure 4-9
5-8 Channel Duplex Hybrid Expansion	1 Main RF Cabinet 1 Expansion RF Cabinet	Figure 4-10
9-12 Channel Duplex Hybrid Expansion	1 Main RF Cabinet 2 Expansion RF Cabinets	Figure 4-11
Sectored	3 Main RF Cabinets	Figure 4-12
CAVITY COMBINING RFDS		
1-5 Channel Omni	1 Main RF Cabinet	Figure 4-9
6-10 Channel Omni Expansion	1 Main RF Cabinet 1 Expansion RF Cabinet	Figure 4-10
11-15 Channel Omni Expansion	1 Main RF Cabinet 2 Expansion RF Cabinets	Figure 4-11
16-20 Channel Omni Expansion	1 Main RF Cabinet 3 Expansion RF Cabinets	Figure 4-11
Sectored	3 Main RF Cabinets	Figure 4-12
800 MHz GEN 4 / 900 MHz RFDS		
1-6 Channel Omni	1 Main RF Cabinet	Figure 4-9
7-12 Channel Omni Expansion	1 Main RF Cabinet 1 Expansion RF Cabinet	Figure 4-10
13-20 Channel Omni Expansion	1 Main RF Cabinet 2 Expansion RF Cabinets	Figure 4-11

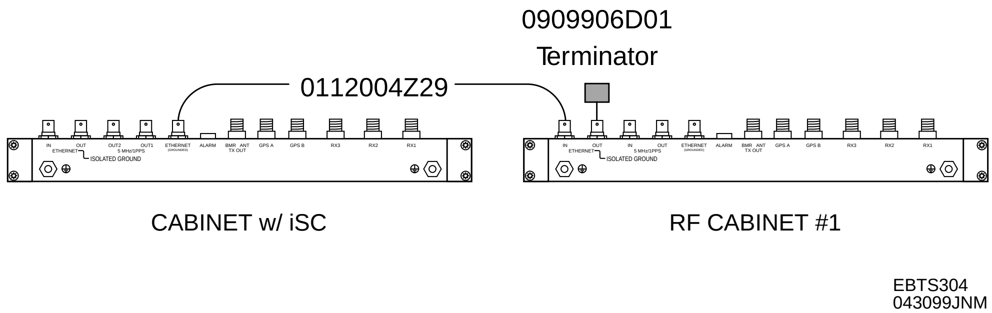


Figure 4-9 ***Ethernet Connections for Single RF Cabinet Omni Sites***

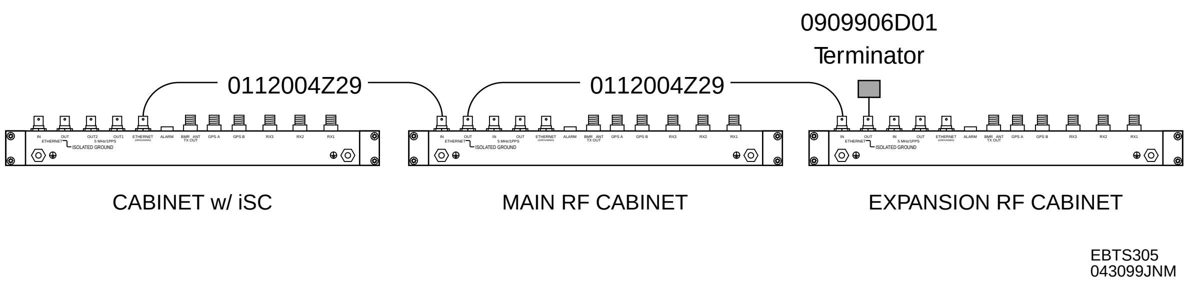


Figure 4-10 ***Ethernet Connections for 2 RF Cabinet Omni Expansion Sites***

Intercabling Connections

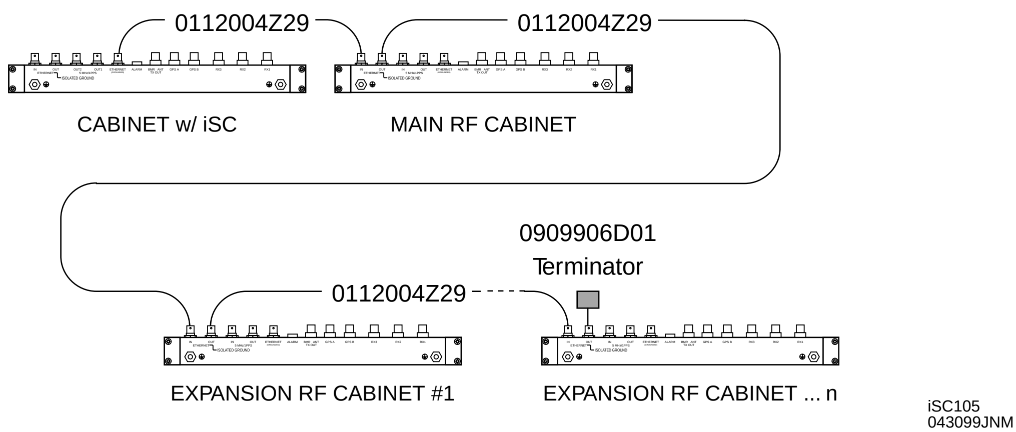


Figure 4-11 ***Ethernet Connections for Sites Using 3 or More RF Cabinets***

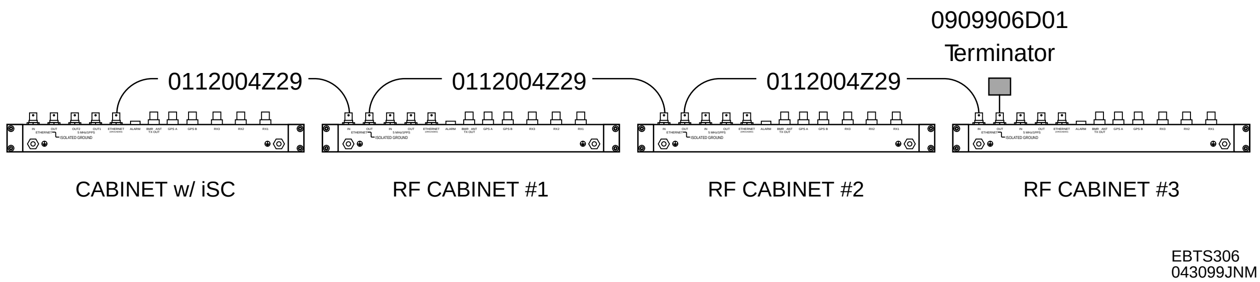


Figure 4-12 ***Ethernet Connections for Sectored Sites***

Alarm intercabling

Cabinet equipment alarm connections are made between the RF Cabinets and the iDEN Monitor Unit (iMU). The location of the alarm connection for the RF Cabinet depends on the type of RF Distribution System (RFDS) that is being used.

- **800 MHz Duplexed and Duplex Hybrid Expansion RFDS (0182020V06 and earlier)** — The alarm connection on the Main RF Cabinet is on the Main RF Cabinet Junction Panel and is labeled **ALARM**. The alarm connection on each Expansion RF Cabinet is located on the RFDS Power Supply tray.
- **800 MHz GEN 4 Duplexed RFDS and 900 MHz Duplexed RFDS —** The alarm connection on the Main RF Cabinet and expansion cabinet(s) is located on the Rx Multicoupler tray on each cabinet.
- **Cavity Combining RFDS** — The alarm connection is located on the RFDS Power Supply tray and is labeled **ALARM**.

Alarm Intercabling Procedure (General)

Perform alarm cabling from the iMU to RF cabinets (RFCs) as follows:

1. Make certain an adequate quantity of RJ45-to-RJ45 cables (P/N 3084225N42) is available. Each RF cabinet requires one cable.
2. Refer to Table 4-16. Noting the type of system being cabled, proceed as directed in Table 4-16.

Alarm Intercabling Procedure (For Systems Using More Than 3 RF Cabinets)

Alarm wiring for the Main RF Cabinet and Expansion RF Cabinets #1 and #2 terminate directly to the iMU rear panel as described above.

Alarm interface for Expansion RF Cabinet #3 is facilitated by Modular Adapter (PN 2882174W03), which breaks-out various signal pairs from iMU punch block 2 (**USER ALARM/CONTROL**) into six modular connectors.

Connect the alarm cable from Expansion RF Cabinet #3 to the modular connector designated as “EXPANSION RF CABINET #3”, as shown in Figure 4-18.

Alarm Intercabling for SRRC

For alarm intercabling information for the SRRC, refer to the SRSC GEN 4 EBTS section of the *EBTS System Manual (68P81099E10)*.

Alarm Intercabling for SRSC

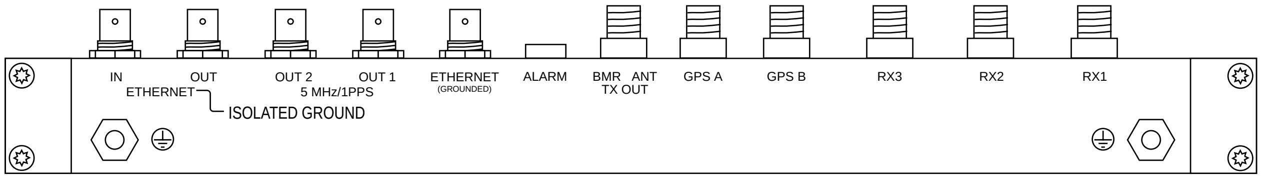
For alarm intercabling information specific to the SRSC, refer to the SRSC GEN 4 EBTS section of the *EBTS System Manual (68P81099E10)*.

Table 4-16 ***Alarm intercabling***

System/Site Type	Intercabling Connections	Perform Cabling As Shown In:
800 MHz DUPLEXED RFDS (0182020V06 and earlier)		
1-5 Channel Omni	• iMU **RF#1** to Main RFC **ALARM** connector	Figure 4-13
5-8 Channel Duplex Hybrid Expansion	• iMU **RF#1** to Main RFC **ALARM** connector • iMU **RF#2** to Expansion RFC **ALARM** connector on Power Supply Tray	Figure 4-13
9-12 Channel Duplex Hybrid Expansion	• iMU **RF#1** to Main RFC **ALARM** connector • iMU **RF#2** to Expansion RFC #1 **ALARM** connector on Power Supply Tray • iMU **RF#3** to Expansion RF Cabinet #2 **ALARM** connector on Power Supply Tray	Figure 4-13
Sectored	• iMU **RF#1** to Main RFC #1 **ALARM** connector • iMU **RF#2** to Main RFC #2 **ALARM** connector • iMU **RF#3** to Main RFC #3 **ALARM** connector	Figure 4-14
800 MHz GEN 4 DUPLEXED RFDS		
1-6 Channel Omni	• iMU **RF#1** to Main RFC alarm connector on Rx Tray	Figure 4-15
7-12 Channel Omni Expansion	• iMU **RF#1** to Main RFC alarm connector on Rx Tray • iMU **RF#2** to Expansion RFC alarm connector on Rx Tray	Figure 4-15
13-18 Channel Omni Expansion	• iMU **RF#1** to Main RFC alarm connector on Rx Tray • iMU **RF#2** to Expansion RFC #1 alarm connector on Rx Tray • iMU **RF#3** to Expansion RFC #2 alarm connector on Rx Tray	Figure 4-15
19/20 Channel Omni Expansion	• iMU **RF#1** to Main RFC alarm connector on Rx Tray • iMU **RF#2** to Expansion RFC #1 alarm connector on Rx Tray • iMU **RF#3** to Expansion RFC #2 alarm connector on Rx Tray • iMU High-Capacity connections to Expansion RFC #3 alarm connector on Rx Tray	Figure 4-15 Figure 4-18

Table 4-16 ***Alarm intercabling — continued***

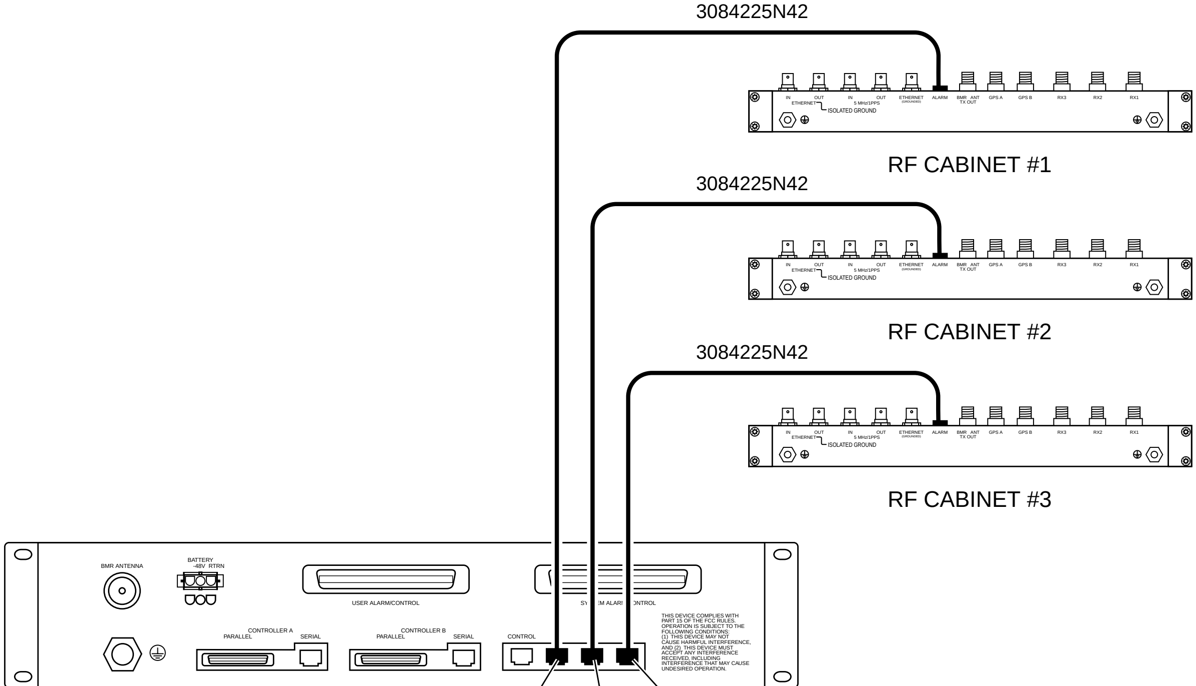
System/Site Type	Intercabling Connections	Perform Cabling As Shown In:
800 MHz CAVITY COMBINING RFDS		
1-5 Channel Omni	• iMU **RF#1** to Main RFC **ALARM** connector on Power Supply Tray	Figure 4-16
6-10 Channel Omni Expansion	• iMU **RF#1** to Main RFC **ALARM** connector on Power Supply Tray • iMU **RF#2** to Expansion RFC **ALARM** connector on Power Supply Tray	Figure 4-16
11-15 Channel Omni Expansion	• iMU **RF#1** to Main RFC **ALARM** connector on Power Supply Tray • iMU **RF#2** to Expansion RFC #1 **ALARM** connector on Power Supply Tray • iMU **RF#3** to Expansion RFC #2 **ALARM** connector on Power Supply Tray	Figure 4-16
16-20 Channel Omni Expansion	• iMU **RF#1** to Main RFC **ALARM** connector on Power Supply Tray • iMU **RF#2** to Expansion RFC #1 **ALARM** connector on Power Supply Tray • iMU **RF#3** to Expansion RFC #2 **ALARM** connector on Power Supply Tray • High-Capacity iMU connection to Expansion RFC #3 **ALARM** connector on Power Supply Tray	Figure 4-16 Figure 4-18
Sectored	• iMU **RF#1** to Main RFC #1 **ALARM** connector on Power Supply Tray • iMU **RF#2** to Main RFC #2 **ALARM** connector on Power Supply Tray • iMU **RF#3** to Main RFC #3 **ALARM** connector on Power Supply Tray	Figure 4-17
900 MHz DUPLEXED RFDS		
1-6 Channel Omni	• iMU **RF#1** to Main RFC alarm connector on Rx Tray	Figure 4-15
7-12 Channel Omni Expansion	• iMU **RF#1** to Main RFC alarm connector on Rx Tray • iMU **RF#2** to Expansion RFC alarm connector on Rx Tray	Figure 4-15



EBTS315
031999JNM

NOTE: 1-5 channel site uses Main RFC only.
5-8 channel site uses Main RFC and expansion RFC.
9-12 channel site uses Main RFC and expansion
RFCs #1 and #2.

Figure 4-13 ***Alarm Connections for 800 MHz Duplexed RFDS (0182020V06 or earlier) Omni Sites***



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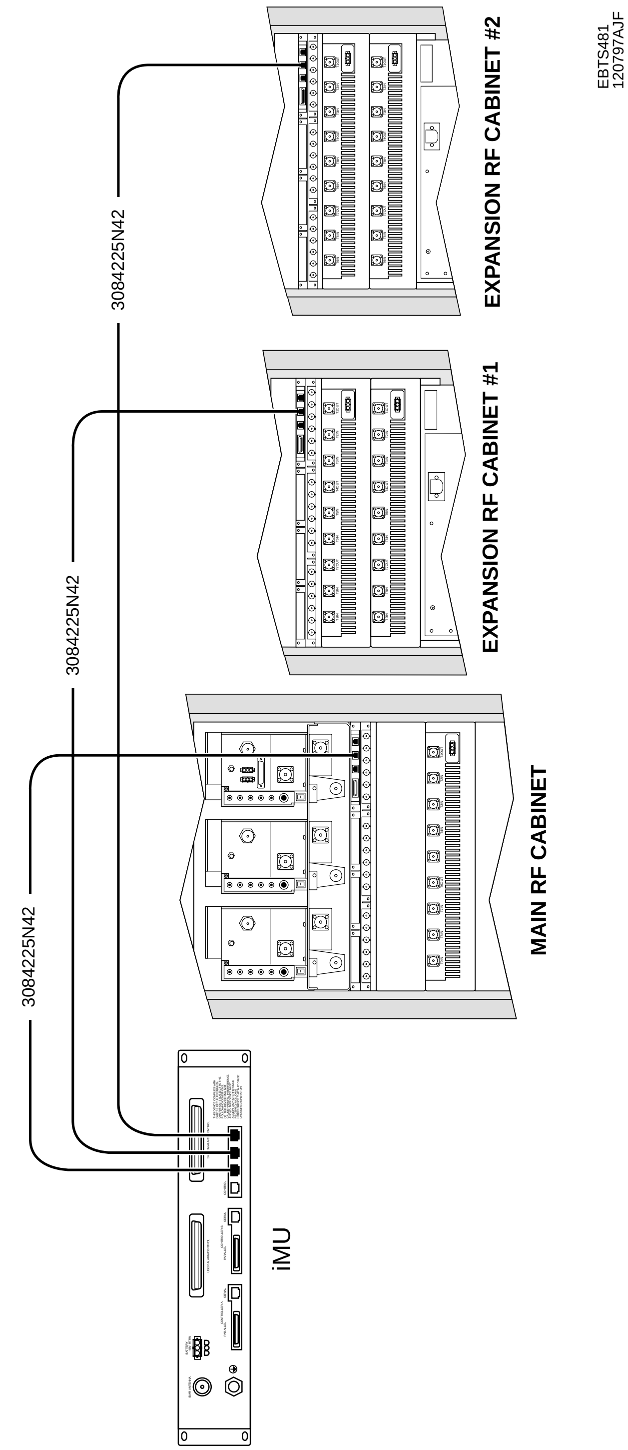
021897JNM

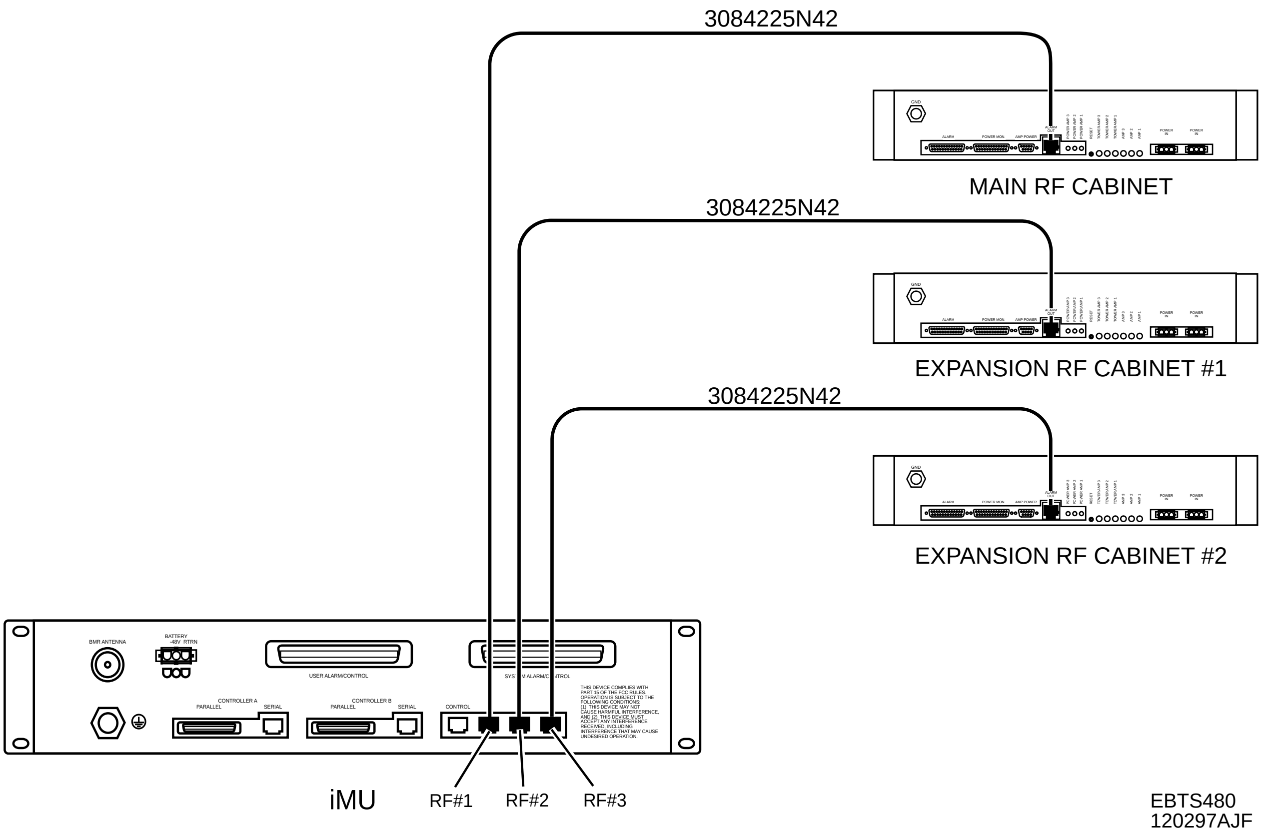
Figure 4-14 ***Alarm Connections for 800 MHz Duplexed RFDS (0182020V06 and earlier) Sectored Sites***

Intercabling Connections



NOTE: For systems using more than 3 RFCs, additional iMU connections are as shown in Figure 4-18, Alarm Connections (Systems with 4-8 RF Racks).

Figure 4-15 ***Alarm Connections for GEN 4 RFDS / 900 MHz Duplexed RFDS Sites***



NOTE: 1-5 channel site uses Main RFC only.
6-10 channel site uses Main RFC and expansion RFC.
11-15 channel site uses Main RFC and two expansion RFCs.
16-20 channel site uses Main RFC and three expansion RFCs. For systems using more than 3 RFCs, additional iMU connections are as shown in Figure 4-18, Alarm Connections (Systems with 4-8 RF Racks).

Figure 4-16 ***Alarm Connections for Cavity Combining RFDS Omni Sites***

Intercabling Connections

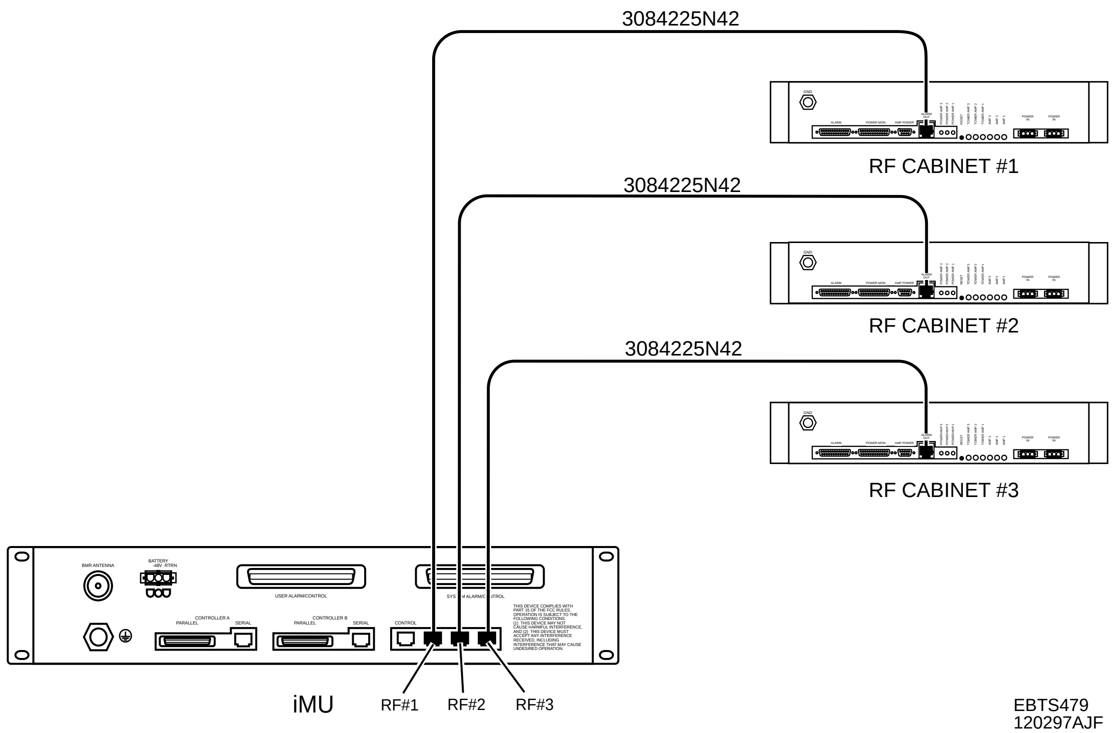


Figure 4-17 ***Alarm Connections for Cavity Combining RFDS Sectored Sites***

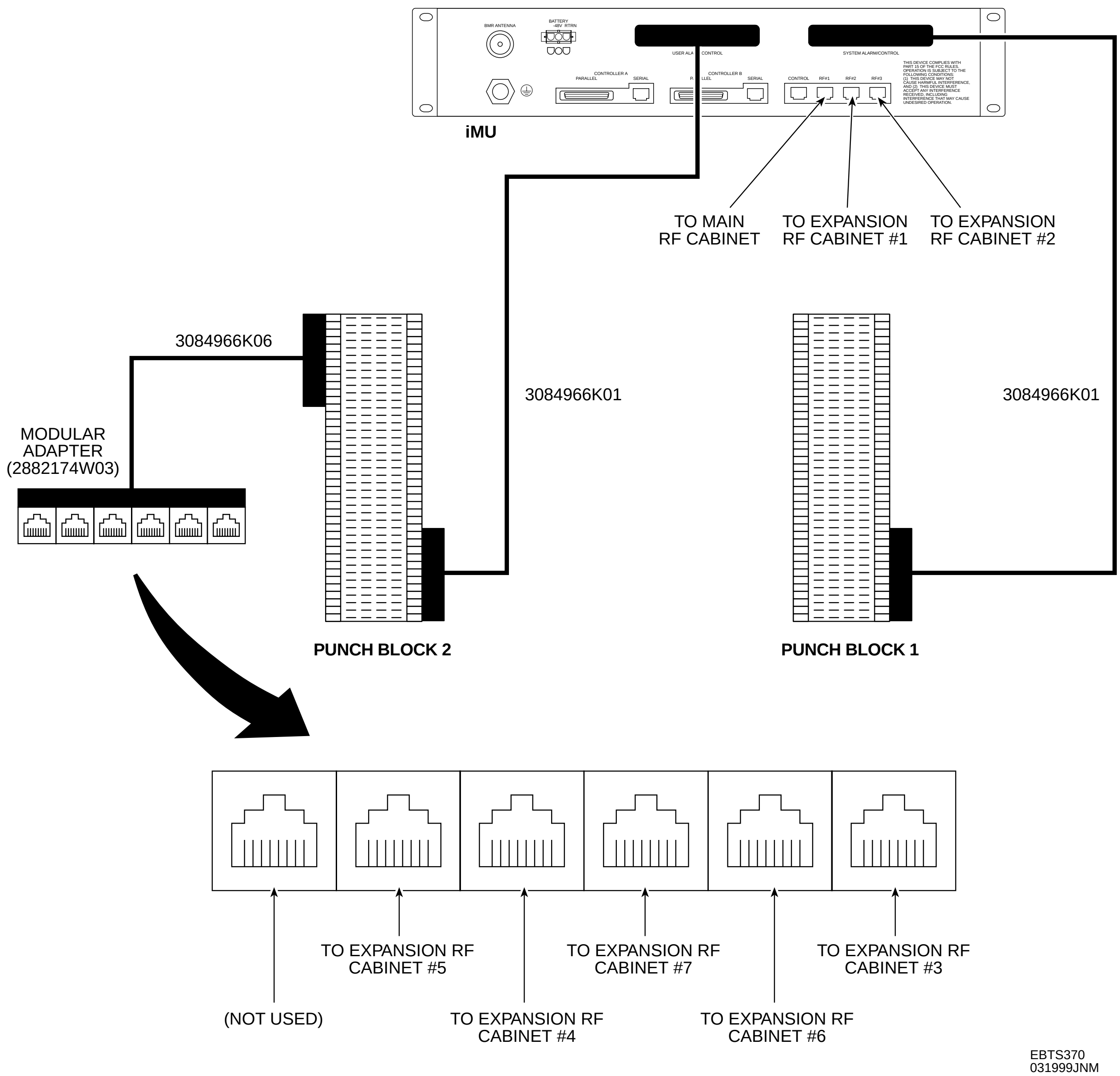


Figure 4-18 ***Alarm Connections (Systems with 4-8 RF Racks)***

Primary control channel redundancy intercabling

On a cavity combining RFDS, additional signaling connections must be made for Primary Control Channel (PCCH) redundancy. There is a PCCH redundancy control cable for each RF Cabinet used in the system.

The red wire is routed to RF Cabinet 1, the blue wire is routed to RF Cabinet 2, and the green wire is routed to RF Cabinet 3. RF Cabinets 2 and 3 are used only in sectored sites. All of the PCCH redundancy control wires (red, blue, and green) branch from the Control modular cable connection on the rear of the iMU.

1. On the iMU, locate the modular cable that is plugged into the Control connector.

   The end of this cable contains three separate branched wires that are colored red, blue, and green.

2. Locate the Mate-N-Lok connector at the end of a colored wire.

   This is a PCCH redundancy control connection for a specific RF Cabinet.

Note: Make sure that each wire is routed to the appropriate RF Cabinet. Red is for RF Cabinet 1, blue is for RF Cabinet 2, and green is for RF Cabinet 3.

3. Route each colored wire to the appropriate RF Cabinet.

4. In the RF Cabinet, locate the loose cable containing another Mate-N-Lok connector.

   This cable is connected to the antenna relay on the rear of the RF Cabinet and to the Auxiliary connector on the BR backplane.

5. Connect the two Mate-N-Lok connectors from the iMU and RF Cabinet together.

6. Repeat this procedure for additional RF Cabinets, if necessary.

GPS antennas

The GPS receiver is part of the Site Reference ISA (SRI) card. Each Controller contains one SRI. Redundancy is accomplished via a second Controller. Each SRI contains a GPS receiver. A GPS antenna is connected to each GPS receiver.

Figure 4-19 shows the SRI connectors and its location within a typical Controller.

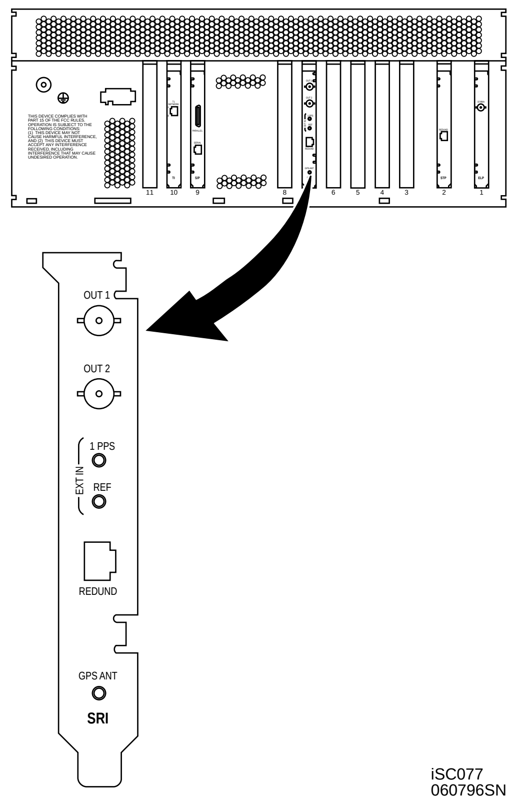


Figure 4-19 ***SRI connections (rear view)***

1. Connect the GPS#1 antenna cable to the GPSA (or RX2 if not using iSC Junction Panel) N-type connector opening on the Junction Panel.

   Extension cables for the antenna feedlines are not provided and must be procured locally. Superflex™ 1/2” cable is the recommended extension cable.

2. If Controller B is installed, connect the GPS#2 antenna cable to the GPSB (or RX3 if not using iSC Junction Panel) N-type connector opening on the Junction Panel.

BMR antennas

The BMR external antenna is connected to the Junction Panel (Figure 4-20). An external attenuator is also connected between the external antenna and the Junction Panel. A cable is routed from the Junction Panel to the iMU BMR antenna port. The BMR antenna port is located on the rear of the iMU. The antennas for the BMR should have been installed in the Pre-Installation chapter.

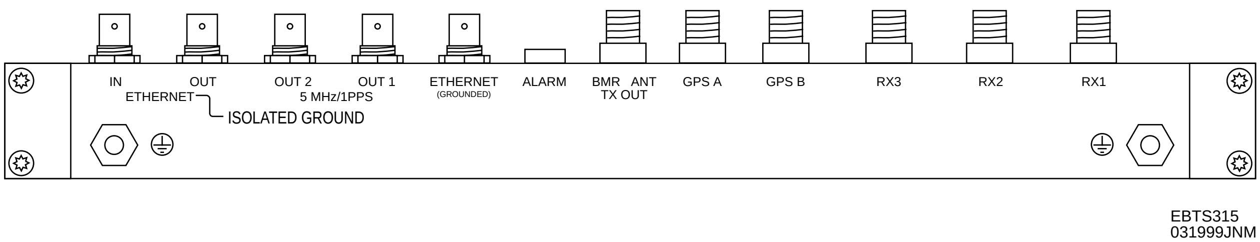


Figure 4-20 ***BMR connection on the Junction Panel (rear view)***

Note: An external RF attenuator must be attached to the antenna port of the BMR to prevent interference and allow proper operation. The attenuator value is site dependent. The procedure to determine the proper value is presented in the iMU chapter.

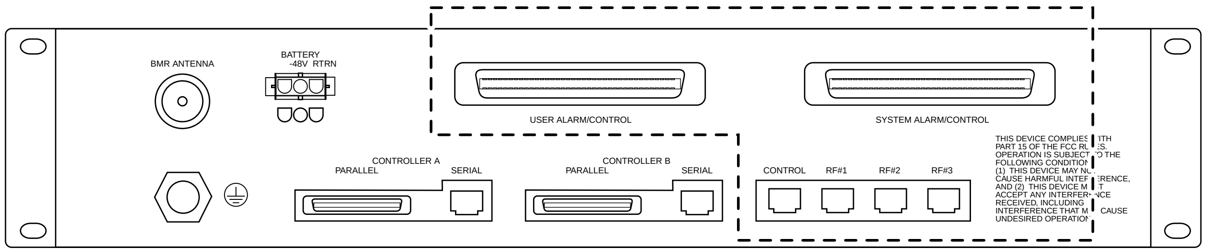
1. Connect the predetermined, fixed attenuator to the BMR ANT N-type connector on the Junction Panel.
2. Pull the BMR antenna feedline down through the top of the cabinet.

   Extension cables for the antenna feedlines are not provided and must be procured locally. Superflex 1/2” cable is the recommended extension cable.
3. Connect the feedline to the N-type connector on the attenuator.

Alarm system cabling

All site alarm wires enter from the top of the cabinet and connect to the rear of the iMU.

The site alarm wiring should have been accomplished during pre-installation. This section gives instructions for connecting the site alarms to the iMU. Figure 4-21 shows the rear view of the iMU. Figure 4-22 shows the connections between the iMU and punch blocks 1 and 2. Punch block 1 contains system alarm/control signals while punch block 2 is typically defined as the “user” alarm/control interface.



iSC058
052296JNM

Figure 4-21 ***Alarm connections on the iMU***

Intercabling Connections

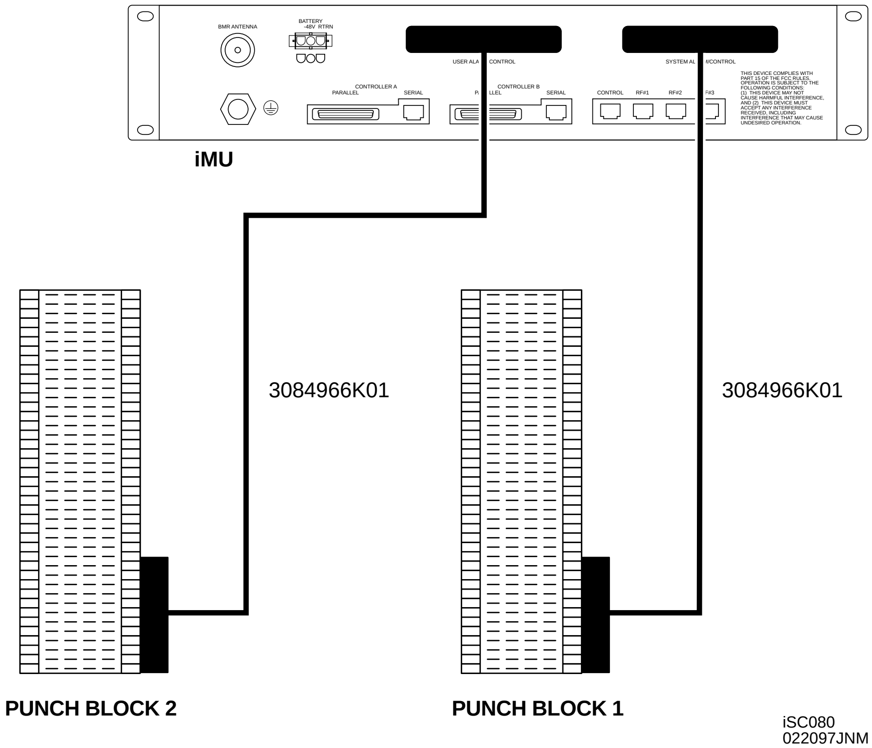


Figure 4-22 ***iMU to punch block 1 and punch block 2 connections***

1. Locate the 50 pin Champ cable (3084966K01) connected to punch block 1.
2. Connect the free end of this cable to the System Alarm/Control connector on the rear of the iMU.
3. Locate the 50 pin Champ cable (3084966K01) connected to punch block 2.
4. Connect the free end of this cable to the User Alarm/Control connector on the rear of the iMU.

iMU connector pin-outs

iMU connectors and punch block information for the standard iSC is listed in Table 4-17. Only the alarm code number is passed to the OMC. The alarm code is the software message relating the punch block pins with the alarm.

Table 4-17 ***Punch block pin-outs***

Alarm code	iMU connector	Punch block pairs	iMU standard alarm connection
201	User Alarm/Control	6, 31	customer defined input
202	User Alarm/Control	5, 30	customer defined input
203	User Alarm/Control	14, 39	customer defined input
204	User Alarm/Control	13, 38	customer defined input
205	User Alarm/Control	12, 37	customer defined input
206	User Alarm/Control	11, 36	customer defined input
207	User Alarm/Control	10, 35	customer defined input
208	User Alarm/Control	9, 34	customer defined input
209	User Alarm/Control	8, 33	customer defined input
210	System/Alarm Control	23, 48	reserved for system use
211	User Alarm/Control	7, 32	customer defined input
212	User Alarm/Control	22, 47	customer defined input
213	User Alarm/Control	21, 46	customer defined input
214	User Alarm/Control	20, 45	customer defined input
215	User Alarm/Control	19, 44	customer defined input
216	User Alarm/Control	18, 43	customer defined input
217	User Alarm/Control	17, 42	customer defined input
218	User Alarm/Control	16, 41	customer defined input
219	System/Alarm Control	7, 32	predefined input, site entry
220	System/Alarm Control	8, 33	predefined input, site high ambient temperature
221	System/Alarm Control	9, 34	predefined input, site low ambient temperature

Intercabling Connections

Table 4-17 ***Punch block pin-outs — continued***

Alarm code	iMU connector	Punch block pairs	iMU standard alarm connection
222	System/Alarm Control	10, 35	predefined input, site smoke detector
223	System/Alarm Control	11, 36	predefined input, site AC surge protector
224	System/Alarm Control	22, 47	reserved for system use
225	RF #3	1, 2	RF Cabinet 3 circuit breaker
226	RF #3	3, 6	RF Cabinet 3 combination/mc amplifier
227	RF #3	5, 8	RF Cabinet 3 combination/mc power supply
228	RF #3	7, 4	RF Cabinet 3 Tower Top Amplifier
229	RF #2	1, 2	RF Cabinet 2 circuit breaker
230	RF #2	3, 6	RF Cabinet 2 combination/mc amplifier
231	RF #2	5, 8	RF Cabinet 2 combination/mc power supply
232	RF #2	7, 4	RF Cabinet 2 Tower Top Amplifier
233	RF #1	1, 2	RF Cabinet 1 circuit breaker
234	RF #1	3, 6	RF Cabinet 1 combination/mc amplifier
235	RF #1	5, 8	RF Cabinet 1 combination/mc power supply
236	RF #1	7, 4	RF Cabinet 1 Tower Top Amplifier
237	CONTROL	1, 2	Control Cabinet circuit breaker
238*	CONTROL	3, 4	output, RF Relay Cabinet 1
239*	CONTROL	5, 6	output, RF Relay Cabinet 2
240*	CONTROL	7, 8	output, RF Relay Cabinet 3

Table 4-17 ***Punch block pin-outs — continued***

Alarm code	iMU connector	Punch block pairs	iMU standard alarm connection
241	System/Alarm Control	21, 46	reserved for system use
242	System/Alarm Control	12, 37	AC Power failure
243	System/Alarm Control	13, 38	low DC voltage
244	System/Alarm Control	14, 39	high DC voltage
245	System/Alarm Control	15, 40	breaker failure alarm
246	System/Alarm Control	16, 41	minor rectifier module failure
247	System/Alarm Control	17, 42	major rectifier failure
248*	System/Alarm Control	30, 6, 5	customer defined output. generator remote start
249	System/Alarm Control	20, 45	reserved for system use
250	System/Alarm Control	19, 44	reserved for system use
251	System/Alarm Control	18, 43	reserved for system use
252	User/Alarm Control	15, 40	customer defined input
253*	System/Alarm Control	26, 2, 1	reserved for system use
254*	System/Alarm Control	28, 4, 3	reserved for system use
255*	User/Alarm Control	26, 2, 1	customer defined output
256*	User/Alarm Control	28, 4, 3	customer defined output

* These alarms are outputs controlled by the iMU and/or OMC.

Punch block signal pair definitions

Table 4-18 lists the system alarm/control signal connections available on punch block 1. Table 4-19 lists the user alarm/control signal connections available on punch block 2.

Note: Although punch block 2 is typically defined as the “user” alarm/control interface, punch block 2 also contains system connections reserved for RFCs 4 through 8. These connections are identified accordingly.

The punch block signal pairs consist of a signal and its respective return connection. In all cases, the lower-number of the pair is the signal function (“hot” connection) and the higher-number is its return.

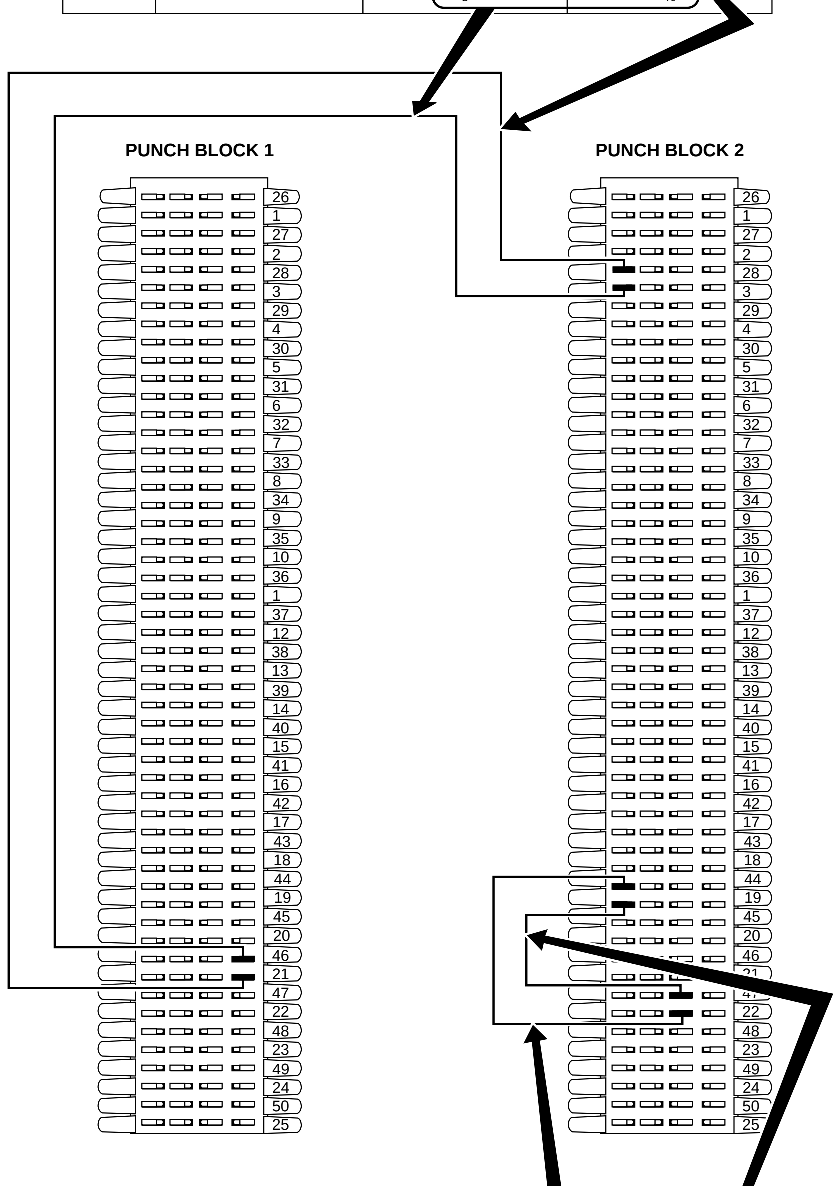
In certain cases, jumpering from punch block 1 to punch block 2, or between the right and left sides of punch block 2 is required. In Tables 4-18 and 4-19, these are identified as entries containing four punch block numbers per alarm function. In these cases, a jumper is required from the pin indicated in the particular row to the pin indicated in the immediately adjacent column.

Figure 4-23 shows examples of punch block-to-punch block jumpering.

iMU modular alarm connections

Table 4-20 lists the alarm connections at modular connectors RF#1 through RF#3 on the iMU rear panel.

Alarm code	iMU function	Punch block 2 signal pairs (left side) (NOTE)	Punch block 1 signal pairs (right side)
241	RFC #4 circuit breaker	28	21
		3	46



Alarm code	iMU function	Punch block 2 signal pairs (left side) (NOTE)	Punch block 2 signal pairs (right side)
212	RFC #6 circuit breaker	44	22
		19	47

iSC099
030497JNM

Figure 4-23 ***Punch block jumpering examples***

Table 4-18 ***Punch block 1 (system alarm) pinouts***

Alarm code	iMU function	Punch block 2 signal pairs (left side) (NOTE)	Punch block 1 signal pairs (right side)
210	reserved for system use		23
			48
219	Site entry		7
			32
220	Site high ambient temperature		8
			33
221	Site low ambient temperature		9
			34
223	Site AC surge protector		11
			36
224	reserved for system use		22
			47
241	RFC #4 circuit breaker	28	21
		3	46
242	AC power failure		12
			37
243	LO DC voltage		13
			38
244	HI DC voltage		14
			39
245	Breaker alarm failure		15
			40
246	Minor rectifier module failure		16
			41

Table 4-18 ***Punch block 1 (system alarm) pinouts — continued***

Alarm code	iMU function	Punch block 2 signal pairs (left side) (NOTE)	Punch block 1 signal pairs (right side)
247	Major rectifier failure		17
			42
248	Generator remote start		6
			5
			30
249	RFC #4 combiner/multicoupler amplifier	27	20
		2	45
250	RFC #4 combiner/multicoupler power supply	26	19
		4	44
251	RFC #4 tower top amplifier	29	18
		1	43
253	reserved for system use		26
			2
			1
254	reserved for system use		28
			4
			3

NOTE: Pinout connections in "Punch block 2" column indicate pins where jumpering between punch blocks 1 and 2 is required. Install jumper from pin specified in "punch block 1" column to the pin specified immediately to the right in "punch block 2" column. For example, on alarm code 249, jumper is to be installed from punch block 1, pin 20 to punch block 2, pin 27.

Intercabling Connections

Table 4-19 ***Punch block 2 (user alarm) pinouts***

Alarm code	iMU function	Punch block 2 signal pairs (left side) (NOTE)	Punch block 2 signal pairs (right side)
201	customer-defined input		6
			31
202	customer-defined input		5
			30
203	RFC #8 circuit breaker	36	14
		11	39
204	RFC #8 combiner/multicoupler amplifier	35	13
		10	38
205	RFC #8 combiner/multicoupler power supply	34	12
		12	37
206	RFC #8 tower top amplifier	37	11
		9	36
207	RFC #7 circuit breaker	32	10
		7	35
208	RFC #7 combiner/multicoupler amplifier	31	9
		6	34
209	RFC #7 combiner/multicoupler power supply	30	8
		8	33
211	RFC #7 tower top amplifier	33	7
		5	32
212	RFC #6 circuit breaker	44	22
		19	47

Table 4-19 ***Punch block 2 (user alarm) pinouts — continued***

Alarm code	iMU function	Punch block 2 signal pairs (left side) (NOTE)	Punch block 2 signal pairs (right side)
213	RFC #6 combiner/multicoupler amplifier	43	21
		18	46
214	RFC #6 combiner/multicoupler power supply	42	20
		20	45
215	RFC #6 tower top amplifier	45	19
		17	44
216	RFC #5 circuit breaker	40	18
		15	43
217	RFC #5 combiner/multicoupler amplifier	39	17
		14	42
218	RFC #5 combiner/multicoupler power supply	38	16
		16	41
252	RFC #5 tower top amplifier	41	15
		13	40
255	customer-defined output		26
			2
			1
256	customer-defined output		28
			4
			3

NOTE: Pinout connections in “Punch block 2 (left side)” column indicate pins where jumpering between punch block 2 left and right sides is required. Install jumper from pin specified in “left side” column to the pin specified immediately to the right in “right side” column. For example, on alarm code 217, jumper is to be installed from punch block left-side, pin 39 to punch block right-side, pin 17.

Table 4-20 ***iMU modular alarm connection pinouts***

Alarm code	Connector	Pins	iMU function
225	RF #3	1, 2	RFC 3 circuit breaker
226	RF #3	3, 6	RFC 3 combiner/multicoupler amplifier
227	RF #3	5, 8	RFC 3 combiner/multicoupler power supply
228	RF #3	7, 4	RFC 3 tower top amplifier
229	RF #2	1, 2	RFC 2 circuit breaker
230	RF #2	3, 6	RFC 2 combiner/multicoupler amplifier
231	RF #2	5, 8	RFC 2 combiner/multicoupler power supply
232	RF #2	7, 4	RFC 2 tower top amplifier
233	RF #1	1, 2	RFC 1 circuit breaker
234	RF #1	3, 6	RFC 1 combiner/multicoupler amplifier
235	RF #1	5, 8	RFC 1 combiner/multicoupler power supply
236	RF #1	7, 4	RFC 1 tower top amplifier
237	CONTROL	1, 2	Control cabinet circuit breaker
238	CONTROL	3, 4	Output: RF relay Sector/Cell 1
239	CONTROL	5, 6	Output: RF relay Sector/Cell 2
240	CONTROL	7, 8	Output: RF relay Sector/Cell 3

iSC to telephone network T1/E1 cabling

The local telephone company installs the T1/E1 line, which terminates in an 8-pin modular plug. This demarcation (demarc) point connects to the T1/E1 through a surge arrestor. Figure 4-24 shows the T1/E1 interface with the system.

The surge arrestor must be adequately grounded as outlined in the *Quality Standards Fixed Network Equipment - Installation Manual (R56)*. It is usually mounted near the demarcation (demarc) point. The cable connecting the surge arrestor to the Telco SmartJack should be provided with the surge arrestor or locally procured. The cable connecting the Controller to the surge arrestor is locally procured.

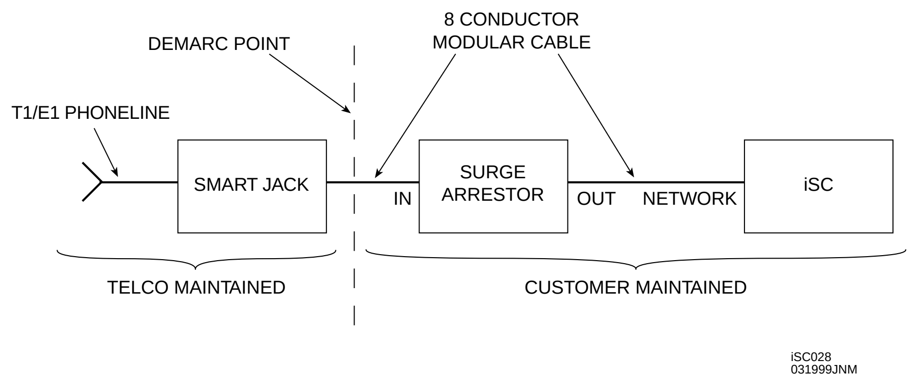


Figure 4-24 ***Telco (T1/E1) interface with the system***

The Telco interface should have been installed in the Pre-installation chapter.

Note: The equipment can be installed and tested without the Telco T1/E1 present, but the T1/E1 must be connected for proper operation of the site.

Note: Some modular cables have a ridge along one side of the cable for purposes of alignment with the connector.

Note: The SmartJack is capable of passing -48V Telco power through to the iSC. This is not required by iDEN for operation. If -48V is present on the network connection to the iSC, the SmartJack is incorrectly configured and the service provider should be contacted to correct it immediately. The SmartJack switch should be set so that -48V power is not passed through to the iSC.

If this cable is locally manufactured, crimp the 8-pin connectors in the “flipped” configuration, as shown in Figure 4-25. Although the connectors at each end of this cable are flipped, the wires should be routed straight through. Make sure that the conductor color is the same at both ends for each conductor of the cable.

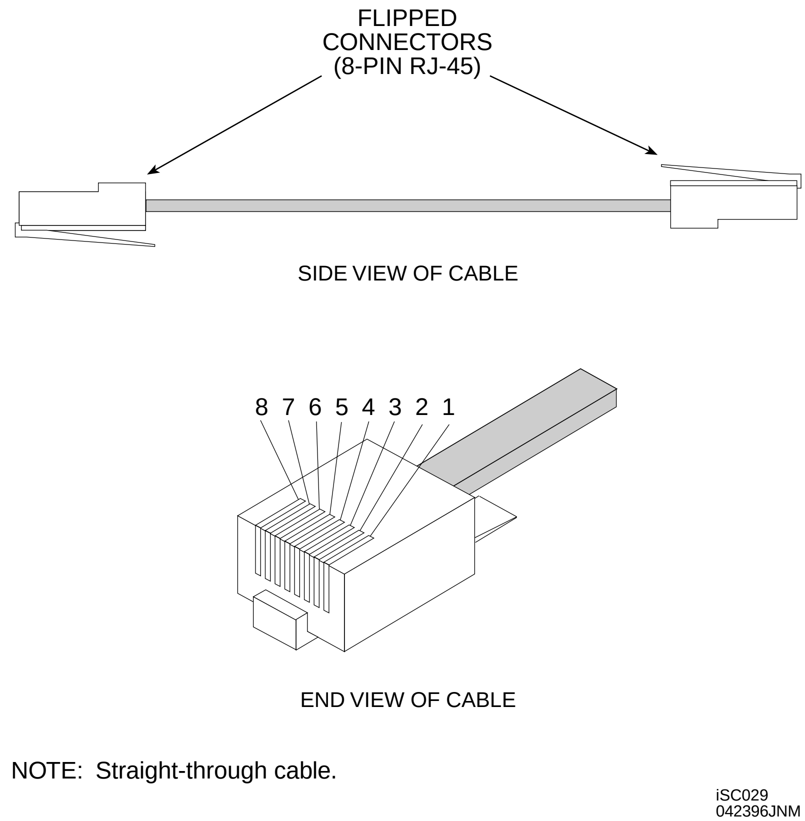


Figure 4-25 ***T1 interface cable configuration***

iSC and iDEN Smartjack Option setting Requirements

For proper operation of the iSC and iDEN system, the Smartjack should be set up with the following options. The telco owns and maintains the Smartjack and should be involved in changes to the switch settings.

- B8ZS Line Coding:

  iDEN requires B8ZS line coding, while many non-iDEN applications use AMI line coding. Improper selection results in “ones density” errors and prevents proper iSC operation. Operators have reported difficulties when the service provider provisions intermediate repeaters with an “auto” function. If problems occur on the span, the intermediate repeaters may automatically start switching between AMI and B8ZS, searching for a signal. Some Smartjacks may have automatic capability as well.

- ESF Framing:

  iDEN requires ESF framing to operate. Intermediate network elements may be configured to automatically switch between SF and ESF framing. This process delays circuit restoration and is difficult to detect without monitoring with the appropriate test equipment. The Smartjack should be set up for ESF framing.

- Loop/Thru Powering

  By passing 48VDC power over the span, this Smartjack option allows the interface to provide (Thru) 48VDC to the customer equipment. The option is set to "loop" if the customer equipment requires a dry contact that terminates the span line power in the Smartjack. Because iDEN does not support 48 VDC on the line, this option must be set to "loop."

  The iSC network interface is automatically powered from the iSC itself. There is no need for 48VDC power from the Smartjack.

CAUTION

The Surge Arrestor installed on the iSC side of the Smartjack will attempt to clamp the 48VDC to approximately 8VDC, which will disrupt iSC operation. If this condition continues, the Surge Arrestor may be damaged and isolated from the rest of the circuit. The iSC may start operating. Proper operation may be observed, but the Surge Arrestor will no longer be providing surge protection. This condition is not immediately apparent but is easily detected with a voltmeter.

The iSC network contains a built-in surge arrestor. If 48VDC is present, the T1/E1 signal will be disrupted, preventing proper operation. If continued, the iSC's power line cross protection circuitry will activate. As long as the 48VDC is present, the circuit will remain open. When the 48VDC is removed, the circuit will close and normal operation may resume as long as the 48VDC is not present.

- Loopback/All Ones

  Some smartjacks have the option of going into loopback, instead of transmitting all ones, upon loss of the iSC signal. The iSC is provisioned to provide an ESF framed, all-ones keep-alive signal when not call processing.

  Many Smartjacks use pulse detection to indicate LOS, however, the iSC will not transmit anything when not powered, thus triggering the transmit LOS circuitry. iDEN operators have indicated that they prefer an "all ones" configuration of the Smartjack in order to maintain the network connection when the EBTS is off-line.

- Code Enable/Disable

  To enable iDEN operators an/or telcos to activate ESF loopback of the Smartjack, this option must be on/enabled in some Smartjacks. While this option does not have any direct effect on the operation of iDEN equipment, it does affect the ability of the operator/service provider to diagnose network problems.

  The iSC responds to the loopback code designated for Channel Service Units, which is different than for the Smartjacks. The iSC responds to ESF loopback codes on the FDL message channel or the in-band loopback code.

MOTOROLA

5

Final Checkout

Chapter overview

This chapter describes the final checkout procedures to be performed after installation of the EBTS equipment is complete. Refer to the *EBTS System Manual (68P81099E10)* for the final checkout of non-iSC equipment. The topics of this chapter are listed in the following table.

Final Checkout Setup

The following procedures should be performed after installation of the iSC is complete. This Final Checkout procedure ensures the proper operation of the iSC.

1. On the Cabinet, set all circuit breakers to OFF.

Figure 5-1 shows the Cabinet Breaker Panel.

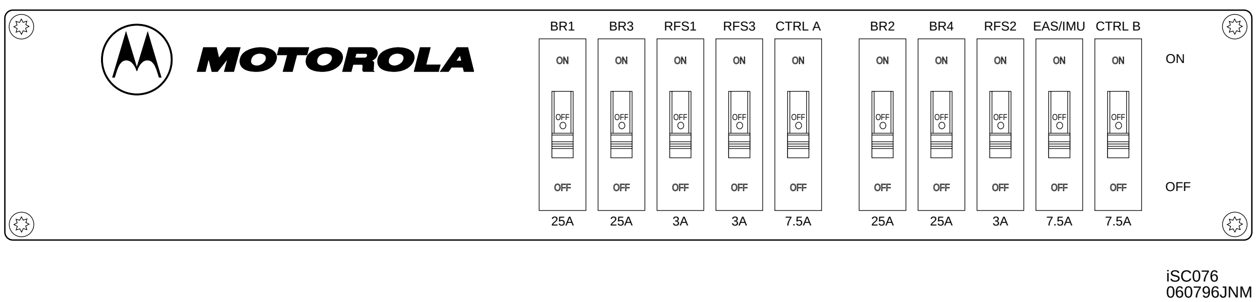


Figure 5-1 ***Cabinet Breaker Panel for standard iSC rack or SRRC (front view)***

For details of the AC/DC Power System for the SRSC, refer to the SRSC GEN 4 EBTS section of the *EBTS System Manual (68P81099E10)*.

Powering the iSC rack

1. On the Power Supply Rack Cabinet Breaker Panel, set breakers ACGA and ACGB to ON.

   This supplies power to the Controllers A and B. Refer to Figure 5-2.

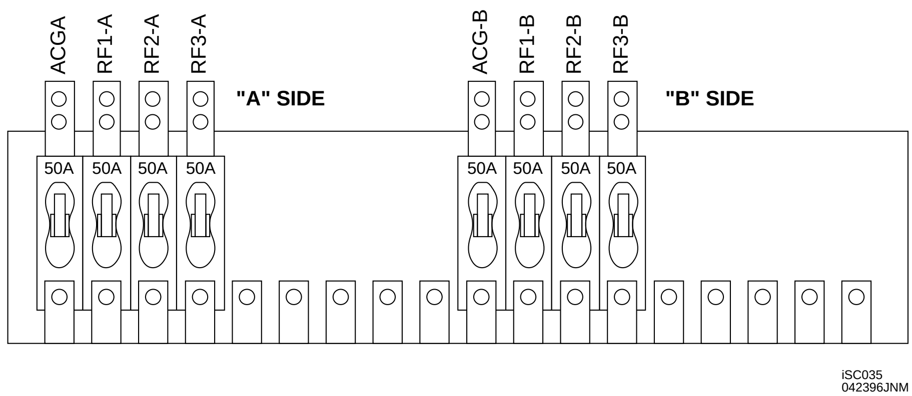


Figure 5-2 ***Power Supply Rack Breaker Panel (front view)***

2. Verify a voltage level between -41 Vdc and -60 Vdc at the -48 Vdc (hot) terminals on the Breaker Panel in the Cabinet.

3. Verify a voltage level of less than 1.0 V between the DC return and chassis ground of the Cabinet.

Circuit Breakers

Note: Breaker panels are always shipped fully configured whether the equipment each circuit breaker controls is installed or not. This procedure requires all breakers to be set to the ON position to prevent the triggering of the breaker alarm indication. All steps must be performed in this procedure to prevent unwanted alarm indications.

1. On the Cabinet breaker panel, set the EAS/IMU breaker to ON. Refer to Figure 5-3.

   Verify that the Power On LED on the iMU is lit.

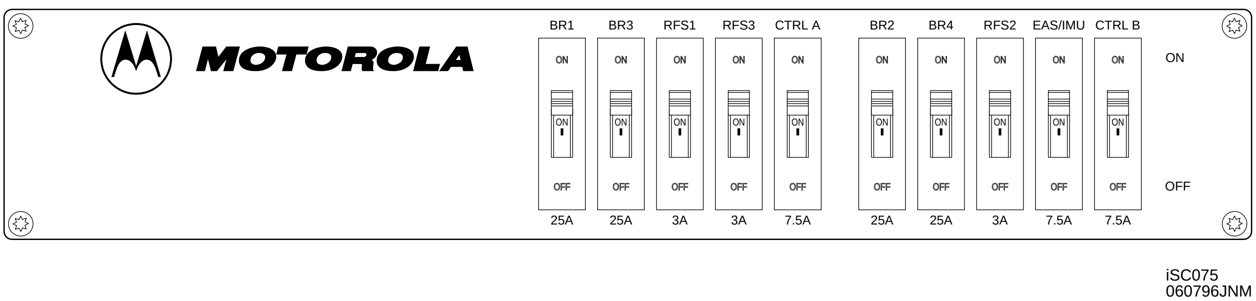


Figure 5-3 ***Cabinet Breaker Panel (front view)***

2. Set the CTRL A breaker to ON.

   Verify that the Power On LED on Controller A is lit.

3. Set the CTRL B breaker to ON.

   Verify that the Power On LED on Controller B is lit.

Note: The SRI requires 13 to 25 minutes to start up for the first time. During this delay, the GPS receiver locates and fixes on satellites. Also, the HSO requires 20 minutes for frequency stabilization.

System Testing

Chapter overview

This chapter provides testing procedures for the iSC. The topics of the System Testing chapter are listed in the following table.

Testing Overview

The testing procedures covered in this chapter are intended to be used in conjunction with the information provided in the System Troubleshooting chapter. Together, the troubleshooting solutions and testing procedures provide the necessary information to isolate failures to a Field Replaceable Unit (FRU). This minimizes system down-time by quickly returning the site to normal operation.

Note: All suspected faulty FRUs should be shipped to a Motorola depot facility for servicing or repair.

MMI commands

Service technicians can communicate with the system through the use of Man Machine Interface (MMI) commands and a service computer. MMI commands provide testing capabilities and access to alarm log files and various diagnostic tests. MMI commands also provide a means to configure the iSC for various system tests.

Two different command sets, integrated Site Controller (iSC) and the Base Radio (BR), allow system testing. These command sets are downloaded from the service computer. Downloading may also be accomplished directly through an available service port on the iSC.

A select number of MMI commands are used in the procedures within this chapter.

Test procedures

The test procedures in this chapter test the functionality of the system and help isolate failures to the FRU level. If a failure cannot be isolated after performing these tests, refer to the tables within the System Troubleshooting chapter for additional information.

iSC Verification

The iSC Cabinet test procedures include downloading the test software and verification of equipment operation within the Cabinet. The Cabinet verification consists of:

Section	Page	This section . . .
Serial download	6-4	describes how to download application code to the service computer and the iSC via the serial port
Ethernet download	6-16	describes how to download application code to the service computer and iSC via the ethernet port
Loading the Base Radios	6-30	describes how to download the application code to each Base Radio
Standby iSC status	6-31	describes how to check the status of the standby iSC system
Base Radio registration and status	6-32	describes how to check the registration and status of each Base Radio within the system
T1 connection test	6-35	describes how to locally manufacture a T1 test cable, set-up, and perform a loop-back test on the T1 line
iMU alarm checkout	6-44	describes how to verify that all site alarms monitored by the iMU are working properly
SRI status	6-48	describes how to check the alarm, GPS, and on-line status of the SRI

Serial download

The serial download section consists of the following;

iSC test equipment – serial

Table 6-1 lists the recommended test equipment for the iSC. This test equipment only applies to the iSC testing procedure.

Table 6-1 ***Test equipment for cabinet testing (serial)***

Equipment	Model/type	Supplier	Description
service computer *	80286 or better	IBM®, IBM compatible, or Macintosh	local service computer
application code	n/a	Motorola	compressed application code used for the iSC
T1/E1 test set	Fireberd	TTC	used to generate a Quasi Random Signal Sequence (QRSS) bit pattern and perform a loop-back test
T1/E1 test cable	n/a	locally procured	connects the T1 test set to the customer maintained T1 circuit

Table 6-1 ***Test equipment for cabinet testing (serial) — continued***

Equipment	Model/type	Supplier	Description
RS-232 cable	n/a	locally procured	straight through connecting cable with DB9 connector for iSC port
communication software	ProComm Plus (except version 2.0.1) (or equivalent)	DataStorm Technologies	host communication
file compression software	PKUnzip	PKWare	used to decompress the application code
serial download software	CVN6090A	Motorola	
* Either a DOS-based computer or Macintosh computer may be used for the service computer. Contact your iDEN System Manager for additional information.			

Service computer start-up – serial

This procedure assumes power is applied to the system. If power is not applied, perform the procedures in the Final Checkout chapter.

In the following procedures, whenever you are instructed to enter software commands, they will be presented in bold lettering. Enter all commands exactly as they appear. The command prompt will precede the command, as in the following example:

iSC> **display stp**

1. Connect an RS-232 cable from the serial port on the service computer to “Service Access” connector on the front of Controller A.

2. Apply power to the service computer.

   After the service computer initializes, the first prompt on the screen identifies the hard drive name. This is most commonly the C:\ drive, but can vary depending on what type of computer is used and how it is configured.

   C:\>

Note: The service computer must contain software to run a telecommunications program capable of performing ASCII file transfers (e.g. ProComm plus).

The following procedures are written for DOS-based service computers. Alternate procedures are available from your iDEN System Manager for Macintosh service computers.

3. Insert the diskette containing the compressed application code into the floppy drive of the service computer.

   The filename of the compressed application code is *iscbrc.zip*.

4. Set the directory where the test file is to be installed using the change directory (cd) DOS command.

   In the following example, iDEN is the directory where the application code is to be installed.

   C:\> **cd iden**

5. Copy the compressed file from the floppy drive of the service computer to the desired directory.

   Be sure to type the filename exactly as it appears in the following example:

   C:\IDEN> **copy a:\iscbrc.zip**

   1 File(s) copied

6. Use PKunzip to expand the compressed file. Once the file is uncompressed, it will have a filename of **iscbrc.hex**.

   Refer to the PKzip help screen for additional information relating to decompressing files.

   Note: If the communications software program has not previously been configured, perform the necessary procedures to configure it for downloading.

   This procedure assumes that ProComm is the communication software being used. If another communication software program is being used, then type the appropriate command.

7. Using the communications software, configure the service computer RS-232 port with the parameters listed in Table 6-2.

Table 6-2 ***RS-232 port configuration***

Description	Setting
Baud rate	19200
Parity bit	none
Data bits	8
Stop bits	1
COM port	COM1

8. Invoke the communications program by typing:

C:\IDEN> **procomm**

iSC start-up sequence – serial

Note: This procedure may be halted and re-started at any time by powering down Controller B and pressing the CPU Reset pushbutton on Controller A.

Note: For ProComm users: The following versions are supported:

• ProComm Plus version 1.1b
• ProComm (all versions)
• ProComm Plus for Windows™ (all versions)

Do not use ProComm Plus version 2.01. Using this version will cause the download to hang.

Serial download

1. Start-up the service computer. For the appropriate start-up procedure, refer to the Service Computer Start-up section in this chapter.

2. Power up Controller A.

3. After the self-test is complete on Controller A, verify that the following messages appear on the service computer terminal:

```
Access Controller Gateway
Firmware Rev RXX.XX.XX
Copyright (c) 1993-1996
Motorola, Inc.

Unauthorized Access Prohibited

To enter configuration mode, hit any key within 10 seconds:
```

4. Press any key within 10 seconds. When prompted, enter the proper password.

   The default password is **factory**.

   The ACG# prompt is displayed on the service computer once the correct password has been entered.

5. At the ACG# prompt, type: **status**

   This command checks the current status of Controller A.

ACG# **status**	
Active/Standby Status:	ACTIVE
MAC Address:	XX:XX:XX:XX:XX:XX
Standby ACG MAC Address	(No Standby ACG)

- If UNKNOWN is displayed, continue to enter the status command until either the active or standby status is displayed.
- If Controller A is indicated as standby, connect the service computer RS-232 cable to Controller B.

Note: The service computer must be connected to the active Controller. The active Controller is determined only after the iSC has initialized. The status of both Controllers must be indicated before cross loading can occur.

Online help

Typing **help** will list all available commands in the iSC command set, prior to downloading.

Loading the iSC – serial

Install software is downloaded from a service computer for specific testing purposes. Install software does not support call processing. After testing is complete, the run-time software and configuration data are loaded into the system via the Operation and Maintenance Center (OMC). To load the final configuration from the OMC, reset the iSCs. The install software will be overwritten with the run-time software.

6. At the ACG# prompt, type **rm ***

   Note: Be sure to leave a space between the rm and *.

7. At the ACG# prompt, type **probe**

8. At the pROBE+> prompt, type **dl**

   Note: **l** is a lower case L.

Note: In this procedure, reference is made to downloading. Downloading refers to the loading of application code into the iSC. The communication program being used may consider loading files from the service computer as uploading.

9. Initiate the download of s-records using the communication software and configuring the service computer to perform an ASCII transfer.

   Refer to the communication software user manual or online help for additional information relating to downloading configurations and procedures.

10. When prompted for a file name, type the location of the decompressed application code file on the service computer.

    iscbrc.hex

    If the location is different than the example above, type the proper location and filename, as determined in Service computer start-up – serial paragraph. After typing the location, the download process should begin.

Note: The number of lines transferred is indicated in the lower left corner of the service computer display. The download is approximately 51000 lines and takes 30 minutes to complete.

11. Based on the communications program and how it is configured, two things can happen when the transfer is finished:

    - The iSC returns with the pROBE+> prompt by itself.

      In this case, type **go**

    - No prompt appears

      In this case, press the RESET button on the Controller and log in again within 10 seconds as described in step 4 on page 6-8.

12. At the pROBE+> prompt, type: **go**

13. At the ACG# prompt, type: **creat -v1 agc.code 10000 270000**

    Note: Be sure to include a space between each text group.

14. At the ACG# prompt, type: **xload**

    This command starts the cross load function.

15. Power up Controller B.

On Controller B

16. When prompted, enter the configuration mode.

17. At the Enter password: prompt, type: **factory**

18. At the ACG# prompt, type: **rm ***

    Note: Be sure to include a space between rm and the *.

19. At the ACG# prompt, type: **exit**

20. Watch the dots. After Controller B has booted, continue with the next step.

The install software has now been loaded into both Controllers.

On Controller A

21. At the ACG# prompt, type: **go**

    The Base Radio will start to download.

    After a few moments, the test software and configuration data will finish downloading into both Controllers and Controller A will become active.

Serial download

22. After it is initialized, the following message is displayed:

```
Integrated Site Controller
Copyright Motorola, Inc. 1995

Is the system T1 or E1? T1

Starting the STP Board.
For STP card number 0, PCI address is 80840000, and irq is 14
The base address for I/O is 81100000
The base address for memory is C0300000
Initializing the IRQs
Initialization of FDL Chip
Putting LIU into loopback
Initialization of PAC Chip
Checking for Framing Errors on the PAC.
Taking LIU out of loopback
>>>Loading the T7130 Micro Code.
Initialization of the T7130 Micro controller
Initialization of Spyders
>>> Initialization of spyder 0

Initialized all the Spyders
Enable the LIU and FDLC IRQ
Enable Card NBR 0
The STP Driver has been Initialized!!! with this number of cards <1>

System configured for T1.
This iSC is the primary iSC running software code version
D02.00.00-INSTALL
The following hardware board versions are installed on this iSC:
   NIC version number 0
   SRC version number 4
```

Respond to this message by typing either **T1** or **E1**. Each response provides a different result, as follows:

- **T1** – returns system configured for T1
- **E1** – returns system configured for E1

23. At the iSC> prompt, type: **test**

Respond to this message by typing either **yes** or **no**. Each response provides a different result, as follows:

- **yes** – returns a detailed diagnostic listing
- **no** – returns an abbreviated diagnostic listing

iSC> **test**

Do you wish long form (yes/no)?**yes**

integrated Site Controller

Atlas PowerPC 603e processor module	available
Subrated T1 PCI (STP) card	available
Site Reference ISA	available
1 Pulse Per Second	available
ROM checksum test performed	successfully
RAM checksum test performed	successfully
Correlation test for the channels performed	successfully
Satellite tracking	adequate
Environmental Alarm Unit (iMU) Status	OK
Ethernet	available
A self test to check the internal logic has been performed	successfully
A time domain reflectory has been performed	successfully
A loopback test has been performed	successfully
T1 communications	OK
Base Monitor Radio (iMU)	available

A device listed as AVAILABLE indicates the hardware and software have initialized and initialization self tests have been successfully completed.

When a device fails testing, one of the following responses is displayed:

- Not Available
- Not Successful
- Unknown
- Unsuccessful
- Not Adequate

Examine the displayed information for any device listed as unavailable. These devices are not working properly and should be replaced. However, be sure the unavailable device has had adequate start-up time.

Note: A GPS receiver takes 13 to 25 minutes to lock to satellites from a cold start (i.e., initial position and time are unknown, all almanac data is older than one month). The GPS receiver will lock to a satellite in less than one minute from a warm start.

The iMU displays one of the following responses to a status request:

- OK
- Time-out on iMU
- Alarms

If the iMU is equipped with alarms, then the current alarms are displayed.

Post download commands for the iSC

At the iSC> prompt, type: **help**

This displays the commands associated with the iSC. The loop e1 and deloop e1 MMI commands are for use with E1 systems only.

iSC> **help**
customer output <activate | deactivate>
deloop e1
deloop t1
display eas
display stp
display sep
display sri alarms
loop e1
loop t1
outport <port#> <data>
ping bmr
ping br <br#>
ping br all
ping br table
ping standby isc
ping sri
status sri
switch isc
whois isc
rf output <output#> <activate | deactivate>
whois br all
whois br <br#>
ver
monitor <locked | gps | alternate | external | reference | 5mhz>

Ethernet download

This section provides the procedures to download software to the Controllers via ethernet. The ethernet download consists of the following;

Section	Page	This section . . .
iSC test equipment – ethernet	6-16	identifies all recommended test equipment for the ethernet download iSC verification
Service computer start-up – ethernet	6-17	describes how to connect and configure a service computer and how to decompress and download the application code via the ethernet port
Configuring the TFTP Daemon – ethernet	6-19	describes how to configure the TFTP Daemon
Loading the iSC – ethernet	6-20	describes how to configure the Controllers and how to load the application code to the active Controller via the ethernet port

iSC test equipment – ethernet

Table 6-3 lists the recommended test equipment to aid in testing the iSC. This test equipment only applies to the iSC testing procedure.

Table 6-3 ***Test equipment for cabinet testing (ethernet)***

Equipment	Model/type	Supplier	Description
service computer *	80386 or better	IBM, IBM compatible, or Macintosh	local service computer w/Windows 95
application code	n/a	Motorola	compressed application code used for the iSC and BRC
T1 test set	209A T-carrier analyzer	T-Berd	used to generate a Quasi Random Signal Sequence (QRSS) bit pattern and perform a loop-back test
T1 test cable	n/a	locally procured	connects the T1 test set to the customer maintained T1 circuit
RS-232 cable	n/a	locally procured	straight through connecting cable with DB9 connector for iSC port

Table 6-3 ***Test equipment for cabinet testing (ethernet) — continued***

Equipment	Model/type	Supplier	Description
LAN card	10 base 2	locally procured	used with service computer
ethernet cables	n/a	locally procured	used to connect the service computer to the ELP on the Controller
ethernet terminator	n/a	locally procured	used to terminate the ethernet connection on the ELP
service computer software	n/a	Microsoft	Windows 95 and Microsoft TCP/IP networking software
LAN software	n/a	locally procured	driver software for LAN adapter (i.e. 3com, Novell®)
Daemon utility	n/a		TFTP Daemon utility
communication software	ProComm Plus (except version 2.0.1) (or equivalent)	DataStorm Technologies	host communication
file compression software	PKUnzip	PKWare	used to decompress the application code
ethernet download software	CVN1030A	Motorola	used to download ethernet
* Either a DOS-based computer or Macintosh computer may be used for the service computer. Contact your iDEN System Manager for additional information.			

Service computer start-up – ethernet

This procedure assumes power is applied to the system. If power is not applied, perform the procedures in the Final Checkout chapter.

In the following procedures, whenever you are instructed to enter software commands, they will be presented in bold lettering. Enter all commands exactly as they appear. The command prompt will precede the command, as in the following example.

BRC> **get rx_freq**

Loading system software on the service computer

1. Apply power to the service computer.

2. Insert the diskette containing the compressed application code into the floppy drive of the service computer.

   The filename for the compressed application code is *iscbrc.zip*

3. Set the directory where the test file is to be installed using the change directory (cd) DOS command.

   We have used iDEN as the directory where the application code is to be installed

   C:\ **cd iden**

4. Copy the compressed file from the floppy drive of the service computer to the desired directory.

   Note: Be sure to type the filename exactly as it appears in the following example.

   C:\ iDEN>**copy a:\iscbrc.zip**

   1 File(s) copied

5. Use pkunzip to expand the compressed file. Once the file is uncompressed, it will have a filename of **iscbrc.hex**.

   Refer to the pkzip help screen for additional information relating to decompressing files.

Configuring the service computer

A set of Internet Protocol (IP) addresses must be assigned to the service computer and each of the Controllers before the software can be downloaded. If the site is on a localized LAN (most cases this is true), the addresses of the form “192.168.0.nn” can be used, where “nn” is a unique number for each device. If the site is connected to an IP network, then the network administrator must be contacted in order to receive the proper addresses.

1. Install the LAN adapter and its drivers (if necessary). Perform the adapter setup steps specified by the adapter manufacturer.

2. Connect the service computer LAN adapter into the system LAN using the required ethernet cables.

In Windows 95, perform the following steps:

3. Click the Start button.

4. Select the Settings/Control Panel.

5. Double-click on the network icon in the Control Panel window.

6. In the Network Configuration window, select Add.

7. In the dialog box, select the Protocol line and click Add.

8. Select the manufacturer Microsoft, and then the Network protocol TCP/IP and click OK.

9. In the Network Configuration window, select TCP/IP and press Properties.

10. Choose the IP Address tab in the TCP/IP properties dialog box and click on the button labeled Specify an IP address.

11. Fill in the IP Address for the service computer (described above) and click OK.

12. Back in the Network Configuration window, click OK.

13. When the message box comes up asking if you wish to restart your computer, click Yes.

The service computer networking software is now properly configured.

Configuring the TFTP Daemon – ethernet

The TFTP Daemon program will be located in the subdirectory *acgbrc.hex*.

Ethernet download

1. Using the Windows file manager, double-click on the Tftpd icon.
2. Select the File/Setup menu.
3. In the setup dialog box, verify the following information:
   - Block Size is set to 128
   - Port Number is set to 34564

   If this information is incorrect, make the necessary changes. Then click the OK button on the setup window.

   The TFTP Daemon is now ready to perform downloads to the Controller.

Loading the iSC – ethernet

Install software is downloaded from the service computer for specific testing purposes.

Note: Install software does not support call processing.

After testing is complete, the run-time software and configuration data are loaded into the Controller via the OMC. To load the final configuration from the OMC, reset the Controllers. The install software will be overwritten with the run-time software.

Configuring Controller A

1. Connect the service computer terminal port to the serial port on Controller A. (“Service Access” connector on the front of the controller)
2. Connect the service computer to the ethernet and start the service computer.
3. Power-up Controller A only.
4. After the self-test is complete on Controller A, verify the following messages appear on the service computer terminal:

```
Access Controller Gateway
Firmware Rev B02.01.00 (PowerPC)
Copyright (c) 1993-1996
Motorola, Inc.

Unauthorized Access Prohibited

Current status:

Active/Standby Status:        UNKNOWN
MAC Address                   08:00:3e:ff:ff:01

To enter configuration mode, hit any key within 10 seconds:
```

5. Press any key within 10 seconds. When prompted, enter the proper password.

   The default password is **factory**.

   The ACG# prompt is displayed on the service computer once the correct password has been entered.

6. At the ACG# prompt, type: **config**

   Note: Press the <CR> at each of the prompts until the IP Address: prompt appears.

7. At the IP Address prompt, type in the IP address that is assigned to Controller A and press <CR>.

8. At the Server IP Address prompt, type in the IP address that is assigned to the service computer and press <CR>.

9. Continue pressing <CR> at each of the rest of the prompts until the ACG# prompt returns.

10. Type **reset** to reset the site in order to make the changes take affect.

11. After the Controller resets and comes back up, log on as described in step 5.

The Controller is now properly configured for downloading.

Loading Controller A

When the TFTP Daemon is running on the service computer, the iSC can make file transfer requests to it.

1. At the ACG# prompt, type the command:

   ACG# **load -i iscbrc.hex**

   When the transfer starts, a series of periods (.) is printed to the Controller console. When finished, the ACG# prompt returns.

```
Loading file “iscbrc.hex” from net address “192.168.0.1”:
        ..............................................................................
        ..............................................................................
Transferred 1406559 bytes
(570764 bytes loaded to memory)
ACG#-
```

   The number of bytes transferred will vary depending on the software you are downloading.

Configuring Controller B

1. Connect the service computer terminal port to the serial port on Controller B (“Service Access” connector on the front of the controller) and start the service computer.

2. Power up Controller B.

3. After the self-test is complete on Controller B, verify the following messages appear on the service computer terminal:

```
Access Controller Gateway
Firmware Rev B02.01.00 (PowerPC)
Copyright (c) 1993-1996
Motorola, Inc.

Unauthorized Access Prohibited

Current status:

Active/Standby Status:          UNKNOWN
MAC Address                     08:00:3e:ff:ff:01

To enter configuration mode, hit any key within 10 seconds:
```

4. Press any key within 10 seconds. When prompted, enter the proper password.

   The default password is **factory**.

   The ACG# prompt is displayed on the service computer once the correct password has been entered.

5. At the ACG# prompt, type: **config**

   Note: Press <CR> at each of the prompts until the IP address: prompt appears.

6. At the IP Address prompt, type in the IP address that is assigned to Controller B and press <CR>.

7. At the server IP Address prompt, type in the IP address that is assigned to the service computer and press <CR>.

8. Continue pressing <CR> at each of the rest of the prompts until the ACG# prompt returns.

9. Type **reset** to reset the site in order to make the changes take effect.

10. After the Controller resets and comes back up, log on as described in step 4.

The Controller is now properly configured for downloading.

Loading Controller B

1. At the ACG# prompt, type the command

   ACG# **load -i iscbrc.hex**

   When the transfer starts, a series of periods (.) is printed to the Controller console. When finished, the ACG# prompt returns:

```
Loading file “iscbrc.hex” from net address “192.168.0.1”:
        ...............................................................................
        ...............................................................................
Transferred 1406559 bytes
(570764 bytes loaded to memory)
ACG#-
```

   The number of bytes transferred will vary depending on the software you are downloading.

Executing the software

1. While the service computer is still attached to Controller B, type the following command at the ACG# prompt:

   ACG# **go 10000**

1. Connect the service computer terminal port to the serial port of Controller A. (“Service Access” connector on the front of the controller)

2. Type the following command at the ACG# prompt:

   ACG# **go 10000**

3. After it is initialized, the following message is displayed:

```
Integrated Site Controller
Copyright Motorola, Inc. 1995

Is the system T1 or E1? T1

Starting the STP Board.
For STP card number 0, PCI address is 80840000, and irq is 14
The base address for I/O is 81100000
The base address for memory is C0300000
Initializing the IRQs
Initialization of FDL Chip
Putting LIU into loopback
Initialization of PAC Chip
Checking for Framing Errors on the PAC.
Taking LIU out of loopback
>>>Loading the T7130 Micro Code.
Initialization of the T7130 Micro controller
Initialization of Spyders
>>> Initialization of spyder 0

Initialized all the Spyders
Enable the LIU and FDLC IRQ
Enable Card NBR 0
The STP Driver has been Initialized!!! with this number of cards <1>

System configured for T1.
This iSC is the primary iSC running software code version
D02.00.00-INSTALL
The following hardware board versions are installed on this iSC:
   NIC version number 0
   SRC version number 4
```

Respond to this message by entering **T1** or **E1**. Each response provides a different result as follows:

- **T1** – returns system configured for T1
- **E1** – returns system configured for E1

4. At the iSC>prompt, type **test**.

Respond to this message by entering **yes** or **no**. Each response provides a different result, as follows:

- **yes** – returns a detailed diagnostic listing
- **no** – returns an abbreviated diagnostic listing

iSC> **test**	
Do you wish long form (yes/no)?**yes**	
integrated Site Controller	
Atlas PowerPC 603e processor module	available
Subrated T1 PCI (STP) card	available
Site Reference ISA	available
1 Pulse Per Second	available
ROM checksum test performed	successfully
RAM checksum test performed	successfully
Correlation test for the channels performed	successfully
Satellite tracking	adequate
Environmental Alarm Unit (iMU) Status	OK
Ethernet	available
A self test to check the internal logic has been performed	successfully
A time domain reflectory has been performed	successfully
A loopback test has been performed	successfully
T1 communications	OK
Base Monitor Radio (iMU)	available

A device listed as AVAILABLE indicate the hardware and software have initialized and initialization self-tests have been successfully completed.

When a device fails testing, one of the following responses is displayed:

- Not Available
- Not Successful
- Unknown
- Unsuccessful
- Not Adequate

Examine the displayed information for any device listed as unavailable. These devices are not working properly and should be replaced. However, be sure the unavailable device has had adequate start-up time.

Note: A GPS receiver takes 13 to 25 minutes to lock to satellites from a cold start (i.e. initial position and time are unknown, all almanac data is older than one month). The GPS receiver locks to a satellite in less than one minute from a warm start.

The iMU displays one of the following responses to a status request:

- OK
- Time-out on iMU
- Alarms

If the iMU is equipped with alarms, then the current alarms are displayed.

Post download commands for the iSC

5. At the iSC> prompt, type: **help**

This displays the commands associated with the iSC. The loop e1 and deloop e1 MMI commands are for use with E1 systems only.

iSC> **help**
customer output <activate | deactivate>
deloop e1
deloop t1
display eas
display stp
display sep
display sri alarms
loop e1
loop t1
outport <port#> <data>
ping bmr
ping br <br#>
ping br all
ping br table
ping standby isc
ping sri
status sri
switch isc
whois isc
rf output <output#> <activate | deactivate>
whois br all
whois br <br#>
ver
monitor <locked | gps | alternate | external | reference | 5mhz>

Loading the Base Radios

The following procedure assumes that the software code has been previously downloaded from the service computer to the iSC. The Base Radio (BR) software must be downloaded to each BR. The software is automatically transferred to each BR connected to the iSC.

1. On the RF Cabinet breaker panel, set all BR breakers to OFF.

2. Apply power to a single BR via the breaker panel on the RF Cabinet and the power switch on the BR Power Supply.

   This begins the download of the application code from the Controller. The service computer displays a message similar to the following during software download:

```
iSC>
downloading code to BR...
cabinet 1 position 3
................
................
................
................
................
Complete Downloading code to BR...
```

Note: If an error occurs during the downloading process, reset the BR to start downloading again.

3. Verify that the BR receiving the download is in the proper cabinet and position.

   If the download is not successful to the proper BR cabinet and position, this indicates that the BR has been mis-programmed or the cabinet is installed improperly. Continue downloading the remaining BRs, and then contact your iDEN System Manager for additional help.

4. Apply power to the next BR.

5. Repeat this procedure for each additional BR.

Standby iSC status

To check the status of the standby Controller, use the following procedure.

At the iSC> prompt, type: **ping standby isc**

Verify the following message on the service computer:

iSC> **ping standby isc**	
Standby isc is	available
processor module	available
Subrated T1 PCI Card	available
Serial/Parallel Transient	available
Standby SRI is	not available

Note: The standby SRI always has a response of NOT AVAILABLE. This is a normal indication and does not indicate a failure.

If the standby iSC is powered off or if there is a communication problem, then a time-out will occur and the following is displayed:

iSC> **ping standby isc**
Ping standby isc is not successful.

Base Radio registration and status

Use the following steps to check the Base Radio registration and status.

Base Radio registration

1. At the iSC> prompt, type: **whois br XX** or **whois br all**

   The variable **XX** represents the cabinet and position of the Base Radio. For example, BR23 is Base Radio in cabinet 2 position 3.

   The word **all** represents all Base Radios.

Note: BR position 1 (BR1) represents the BR mounting position within the cabinet which is closest to the floor while position 5 represents the highest from the floor.

2. Verify a message similar to the following is displayed on the service computer:

```
iSC> whois br all
BR cabinet 1 position 1 ethernet address 00:00:00:00:00:00
BR cabinet 1 position 2 ethernet address 00:00:00:00:00:00
BR cabinet 1 position 3 ethernet address 00:00:00:00:00:00
BR cabinet 1 position 4 ethernet address 00:00:00:00:00:00
BR cabinet 1 position 5 ethernet address 00:00:00:00:00:00
BR cabinet 2 position 1 ethernet address 00:00:00:00:00:00
BR cabinet 2 position 2 ethernet address 00:00:00:00:00:00
BR cabinet 2 position 3 ethernet address 00:00:00:00:00:00
BR cabinet 2 position 4 ethernet address 00:00:00:00:00:00
BR cabinet 2 position 5 ethernet address 00:00:00:00:00:00
BR cabinet 3 position 1 ethernet address 00:00:00:00:00:00
BR cabinet 3 position 2 ethernet address 00:00:00:00:00:00
BR cabinet 3 position 3 ethernet address 21:00:41:51:61:72
BR cabinet 3 position 4 ethernet address 00:00:00:00:00:00
BR cabinet 3 position 5ethernet address 00:00:00:00:00:00
BR cabinet 3 position 5 ethernet address 00:00:00:00:00:00
```

```
iSC> whois br 11
BR cabinet 1 position 1 ethernet address 00:00:00:00:00:00
```

Note: If the Ethernet address is 00:00:00:00:00:00, the Base Radio is not registered.

Note: In the previous example for **whois br all**, only BR 33 is registered.

Checking Base Radio status

1. At the iSC> prompt, type: **ping br XX** or **ping br all**

The **XX** represents the cabinet and position of the Base Radio. For example, BR23 is a Base Radio in cabinet 2 position 3.

The word **all** represents all Base Radios.

2. Verify the following messages on the service computer:

XX represents information that changes from site to site.

```
iSC> ping br 11
Base Radio 11        available
1 PPS                available
5 MHz                available
TX Frequency         XX MHz
TX keyed             off
RX Frequency         XX MHz
```

```
iSC> ping br 23
Ping br 23 is        not successful
```

The service computer displays NOT SUCCESSFUL if the iSC cannot communicate with the BR. An example is shown at the bottom of the terminal message above with BR 23.

T1 connection test

The T1 connection test requires an external test set capable of generating a Quasi Random Signal Sequence (QRSS) bit pattern and the ability to perform a loop-back test.

T1 custom test cable

A custom interface cable is required to connect the test set to the circuit selected for testing. Use locally procured parts and the pin-out shown in Figure 6-1 to manufacture this cable.

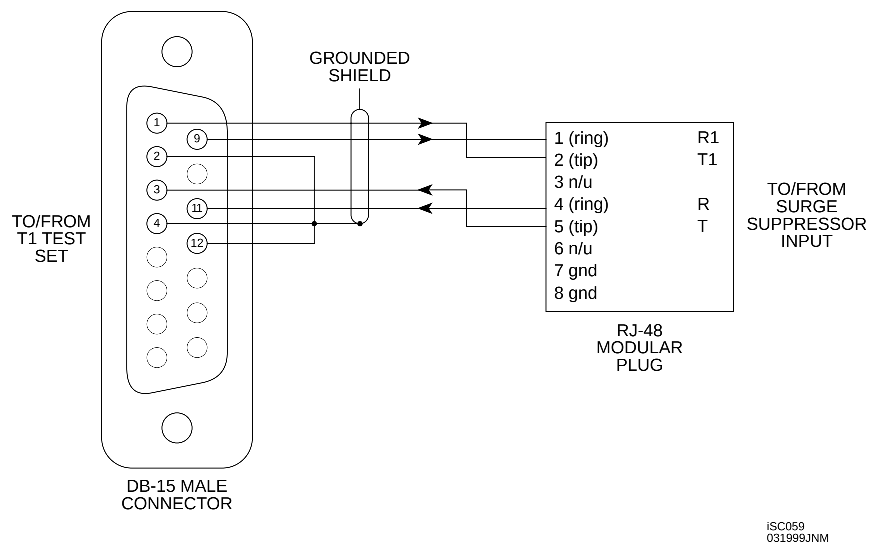


Figure 6-1 ***Pin-outs for the T1 test cable***

T1 test set-up

The following T1 test procedure uses the TTC Fireberd T1 test set.

1. Connect the 15-pin connector test cable to the T1 test set.

Figure 6-2 shows this connection.

T1 connection test

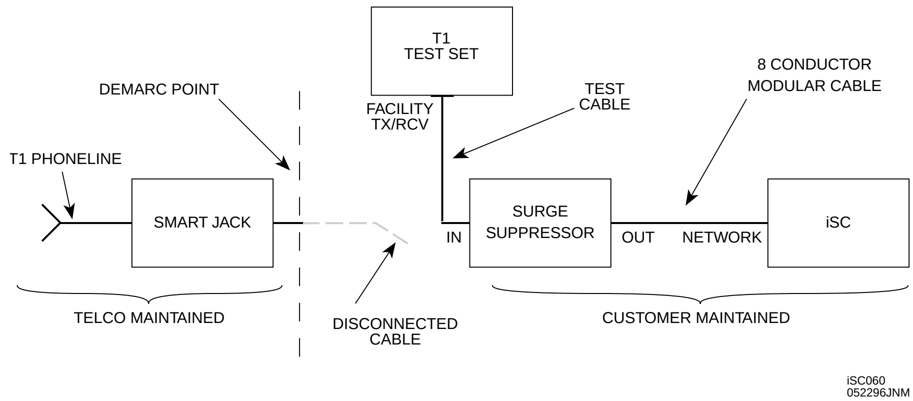


Figure 6-2 ***T1 test connections***

2. Disconnect the Telco SmartJack from the Telco surge arrestor.

3. Connect the T1 test set into the surge arrestor.

If the Controller is not currently connected to the Telco demarcation point, the T1 test set can be plugged directly into the Controller.

4. Configure the T1 test set to the settings indicated in Table 6-4.

Table 6-4 ***Settings for the T1 test set***

Function	Setting
Receive input	Term
Transmit output	0dB(DSX)
Timing	Int
Test	Cont
Code	B8ZS
Print Event	Off
Mode	ESF
Pattern	T1-QRSS
Results I	Summary
Results II	Time

T1 test procedure

This test involves equipment looping using the **loop t1** and **deloop t1** MMI commands.

Note: Do not use the test set Loop Code switches. Pressing Loop Up or Loop Down affects the loop-back test.

1. At the prompt, type: **loop t1**

   This command displays the following message on the service computer:

```
iSC> loop t1
T1 interface in loopback mode
```

2. Press the RESTART button on the T1 test set to clear the display and start the test.

   Run the test uninterrupted for five minutes. No errors should be detected.

3. Use the Up and Down arrow keys on the test set keyboard to scroll through the results.

   These keys are located next to the Results I key.

4. At the iSC> prompt, type: **deloop t1**

   This command stops the iSC from looping the T1 line. The following message is displayed:

iSC> **deloop t1**
T1 interface returned to normal mode

Remotely Looping Back the T1 Integrated Site Controller for BER Testing

Flash loading the iSC with SR7.0 or later Boot ROM software will provide T1 loop-back features not available in previous releases. System operators should be aware that previous system releases did not support loop-back when the iSC was operating from the Boot ROMs. With SR7.0 or later boot ROM flash load, the iSC will no longer reset after it has been put into loop-back . It is up to the system operator to send the appropriate loop-down commands to end the loop-back.

Loop-back capability has always existed for the iSC when it is operating under software down-loaded from the OMC. When performing a loop-back test the data links between the MSO and the EBTS are broken. There is a timer, in the iSC downloaded software, whose default value is set to one hour. When the links have been broken for one hour this timer initiates an iSC reset and clears the loop-back. The value of this timer can be changed to run a longer loop-back test. This timer does not effect loop-backs when iSC is operating under Boot ROM software.

Two Types of T1 Loop-Back

Line Loop-Back

Line Loop-Back connects the received data from the Network to the line driver an the STP card in the iSC. The data is passed through the iSC unchanged. All framing errors, CRC errors, Bipolar Violations, and Data errors are passed back to the network as they were received.

Payload Loop-Back

Payload Loop-Back takes the received data from the line and loops it back through the framer chip. This loops back the data on the 24 DS0s, but generates new framing bits and CRC. All Bipolar violations are removed. A new data stream is created for the Facility Data Link.

Three Different Ways to Start and Stop a T1 Line Loop-Back on the iSC

Inband Line Loop-Back

A craftsperson inserts a T1 test set into the line going to the iSC. The test box then sends a Loop-Up code consisting of a repeating `00001` pattern across the entire T1 frame. All 24 DS0s have the data pattern across them. The STP card, in the iSC, detects this pattern and goes into Loop-Back mode.

When the craftsperson is done testing the T1 line they will send the inband loop down code to the iSC. This consists of a repeating `001` pattern across the entire T1 frame. The STP card, in the iSC, detects this and quits Looping the T1. Normal operation on the T1 line can now begin.

Front Panel Line Loop-Back Switch

There is a Loop-Back Switch located on the front panel of the iSC. When the Loop switch is pressed it puts the STP card, in the iSC, into Line Loop-Back. When the Loop switch is pressed again it deactivates the Line Loop-Back.

Line Loop-Back from a ANSI T1.403 Loop-Back Command on The Facility Data Link

A craftsperson uses a T1 test set and inserts it into the line going to the iSC. The test box then sends a T1.403 Line Loop-Up bit oriented message on the FDL towards the iSC.

When the craftsperson is done testing the T1 line he sends a T1.403 Line Loop-Down bit oriented message on the FDL towards the iSC. The STP card removes the Line Loop-back.

The T1.403 line loop-up and down commands are transmitted on the T1 Extended Super Frame Facility Data Link. The Loop-up Bit-Oriented Message is `00001110 11111111` with the rightmost bit transmitted first. The Loop-down Bit-Oriented Message is `00111000 11111111` with the rightmost bit transmitted first.

How Payload Loop-Back works on the iSC

A craftsperson inserts a T1 test set and inserts it into the line going to the iSC. The test box then sends a T1.403 Payload Loop-Up bit oriented message on the FDL towards the iSC.

When the craftsperson is done testing the T1 line he sends a T1.403 Payload Loop-Down bit oriented message on the FDL towards the iSC. Normal operation on the T1 line can now begin.

The T1.403 T1 payload loop-up and down commands are transmitted on the T1 Extended Super Frame Facility Data Link. The Payload Loop-up Bit-Oriented Message is `00010100 11111111` with the rightmost bit transmitted first. The Payload Loop-down Bit-Oriented Message is `00110010 11111111` with the rightmost bit transmitted first.

Starting and Stopping Loop-backs

If someone starts a line loop-back using the inband loop-up code they will need to terminate the loop-back using the inband loopdown code. There are two different loop-back decoders on the STP card in the iSC. One decoder is for inband signaling, and one decoder is for Facility Data Link signaling. A T1.403 Line Loop-Down bit oriented message, on the FDL, will not loop-down the iSC if it was looped-up with a inband loop-up code. Likewise an iSC that was looped-up with a T1.403 Line Loop-Up bit oriented message, on the FDL, will not de-loop if an inband loop-down code is sent. Payload loop-back is a case by its self. The only way to start a payload loopback is with the T1.403 payload loop-up command. The only way to loop it down is with the payload loop-down command.

Remotely Looping Back the E1 Integrated Site Controller for BER Testing

Flash loading the iSC with SR7.0 or later Boot ROM software will provide E1 loop-back features not available in previous releases of software. System operators should be aware that previous system releases did not support loop-back when the iSC was operating from the Boot ROMs. With the SR7.0 or later boot ROM flash load, the iSC will no longer reset after it has been put into loop-back . It is up to the system operator to send loop-down command to end the loopback.

Loop-back capability has always existed for the iSC when it is operating under software down-loaded from the OMC. When performing a loop-back test the data links between the MSO and the EBTS are broken. There is a timer, in the iSC downloaded software, whose default value is set to one hour. When the links have been broken for one hour this timer initiates an iSC reset and clears the loop-back. The value of this timer can be changed to run a longer loop-back test. This timer does not effect loop-backs when iSC is operating under Boot ROM software.

Line Loop-Back connects the received data from the Network to the line driver on the SEP card in the iSC. The data is passed through the iSC unchanged. All framing errors, CRC errors, Bipolar Violations, and Data errors are passed back to the network as they were received.

Two Different Ways to Start and Stop a E1 Line Loop-Back on the iSC

Inband Line Loop-Back

A craftsperson inserts a E1 test set into the line going to the iSC. The test box then sends a Loop-Up code consisting of a repeating `00001` pattern across the entire E1 frame. All 32 DS0s have the data pattern across them. The SEP card, in the iSC, detects this pattern and goes into loop-back mode. The iSC will not recognize the `00001` pattern if HDB3 (High-Density Bipolar of Order 3) encoding is used. In HDB3 encoding an occunence of 4 zeros in a row is substituted with a bipolar violation substitution word. The loopback decoder in the iSC does not recognize this bipolar violation substitution. Therefore, for the iSC recognize the `00001` code word AMI line coding must be used. AMI encoding will allow a string of 4 zeros in a row to be transmitted. After the iSC has been put into loop-back mode the BER test box may be changed back to HDB3 line encoding if desired. In normal operation the iSC uses HDB3 line coding.

When the craftsperson is done testing the E1 line they will send the inband loop down code to the iSC. This consists of a repeating `001` pattern across the entire E1 frame. The SEP card, in the iSC, detects this and quits Looping the E1. Normal operation on the E1 line can now begin. The loop-down code does not contain more than four zeros in a row so HDB3 or AMI line coding may be used to loopdown the iSC.

Front Panel Line Loop-Back Switch

There is a Loop-Back Switch located on the front panel of the iSC. When the Loop switch is pressed it puts the SEP card, in the iSC, into Line Loop-Back. When the Loop switch is pressed again it deactivates the Line Loop-Back.

iMU alarm checkout

The following procedure verifies correct wiring of the alarms monitored by the iMU.

1. At the iSC> prompt, type: **display eas**

   Information similar to the following is displayed on the service computer:

```
iSC>display eas
CODE    DESCRIPTION
237     Control cabinet circuit breaker                          o.k.
233     RF cabinet 1 circuit breaker                             o.k.
234     RF cabinet 1 combiner /multicoupler Amplifier            o.k.
235     RF cabinet 1 combiner/multicoupler power supply          o.k.
228     RF cabinet 3 tower top amplifier                         o.k.
238     RF cabinet 1 PCCH Redundancy Control Output              inactive
229     RF cabinet 2 circuit breaker                             o.k.
230     RF cabinet 2 combiner /multicoupler Amplifier            o.k.
231     RF cabinet 2 combiner/multicoupler power supply          o.k.
236     RF cabinet 1 tower top amplifier                         o.k.
239     RF cabinet 2 PCCH Redundancy Control Output              inactive
225     RF cabinet 3 circuit breaker                             o.k.
226     RF cabinet 3 combiner /multicoupler Amplifier            o.k.
227     RF cabinet 3 combiner/multicoupler power supply          o.k.
232     RF cabinet 2 tower top amplifier                         o.k.
240     RF cabinet 3 PCCH Redundancy Control Output              inactive
245     Power system breaker fail                                o.k.
246     Rectifier Module Fail (minor)                            o.k.
247     Rectifier Module Fail (major)                            o.k.
243     Low Voltage                                              o.k.
244     High Voltage                                             o.k.
242     AC Power Failure                                         o.k.
219     Site Entry                                               o.k.
220     Site High Ambient Temperature                            o.k.
221     Site Low Ambient Temperature                             o.k.
222     Site Smoke Detector                                      o.k.
223     Site AC Surge Protector                                  o.k.
224     System use                                               o.k.
207     Customer input                                           o.k.
208     Customer input                                           o.k.
211     Customer input                                           o.k.
212     Customer input                                           o.k.
213     Customer input                                           o.k.
214     Customer input                                           o.k.
215     Customer input                                           o.k.
216     Customer input                                           o.k.
217     Customer input                                           o.k.
218     Customer input                                           o.k.
248     Generator remote start                                   inactive
```

Note: The tower top amplifier response (codes 228, 232, and 236) to the **display eas** command is only returned on systems containing a cavity combining RF Distribution System.

2. To verify a particular alarm, perform the proper action to trigger it.

For example, the following describes this verification.

2.1 Open the site entry door.

2.2 Type: **display eas**

The status of the Site Entry alarm (code 219) changes to the alarm state.

2.3 Close the site door.

2.4 Type: **display eas**

The Site Entry alarm (code 219) returns the O.K. condition.

3. Verify other alarms for proper wiring by triggering them as described above.

Some actions can trigger more than one alarm, such as switching off the main breaker to the Controller. Other alarms are site specific and may or may not be wired. These are generally more difficult to trigger on a manual basis.

The alarm actions listed below were selected so that power is not removed from the Controller. The testing procedure will be disrupted if power is removed from either the Controller.

A list of alarms and actions required to trigger each are given in Table 6-5.

Table 6-5 ***Alarm action and alarm responses***

If you do this . . .	Then this alarm triggers . . .
Open site entry door	Site entry
Set off smoke alarm	Site smoke detector
Trip thermostat high point	Site high ambient temperature
Trip thermostat low point	Site low ambient temperature
Switch off the EAS/IMU breaker	Control equipment cabinet circuit breaker alarm

Table 6-5 ***Alarm action and alarm responses — continued***

If you do this . . .	Then this alarm triggers . . .
Switch off the RFS1 breaker of RFC1	RFC 1 circuit breaker and combiner/ multicoupler power supply
Switch off the RFS1 breaker of RFC2	RFC 2 circuit breaker and combiner/ multicoupler power supply
Switch off the RFS1 breaker of RFC3	RFC 3 circuit breaker and combiner/ multicoupler power supply
Switch off both RFS1&2 breakers of RFC1	RFC 1 combiner/multicoupler amplifier RFC 1 combiner/power supply RFC 1 circuit breaker RFC 1 tower top amplifier *
Switch off both RFS1&2 breakers of RFC2	RFC 2 combiner/multicoupler amplifier RFC 2 combiner/power supply RFC 2 circuit breaker RFC 2 tower top amplifier *
Switch off both RFS1&2 breakers of RFC3	RFC 3 combiner/multicoupler amplifier RFC 3 combiner/power supply RFC 3 circuit breaker RFC 3 tower top amplifier *
Switch off the AC circuit breaker for rectifier 1 at the site power panel	AC power failure Minor rectifier alarm
Switch off any breaker in the Power Supply rack **	Power system breaker fail
If possible, turn off the AC power for rectifiers 1 and 2 in the Power Supply rack	Major rectifier alarm
Switch off any RF Cabinet 1 breaker	RFC 1 circuit breaker
Switch off any RF Cabinet 2 breaker	RFC 2 circuit breaker
Switch off any RF Cabinet 3 breaker	RFC 3 circuit breaker
* Only present on RF Cabinets containing cavity combining RF Distribution Systems. ** Breaker alarms may take time to appear.	

SRI status

Use these procedures to verify the Site Reference ISA (SRI) status.

1. At the iSC> prompt, type: **ping sri** or **display sri alarms**

2. Verify the following information is displayed on the service computer:

iSC> **ping sri**

Site Reference ISA (SRI)	unknown
alarm status	unknown
Satellite tracking	unknown
1 PPS	not available

iSC> **display sri alarms**

Site Reference ISA (SRI)	unknown
alarm status	unknown
Satellite tracking	unknown
1 PPS	not available

The SRI is on line when the green On Line LED on the Controller Reference Status grouping is lit.

The possible responses are:

- **On line** – the active SRI is on line
- **Off line** – the standby SRI is off line

If the standby or active SRI lists the Satellite tracking as NOT ADEQUATE, make sure:

- the GPS receiver has been allowed enough time (25 minutes max.) to locate the satellites
- the GPS antenna cable is properly connected. If it is, the GPS antenna is possibly faulty

CAUTION

Do not attempt to make a resistance check of the GPS antenna. Damage to the active devices within the antenna element may result.

3. At the iSC> prompt, type: **status sri**

   This command displays a detailed site reference analysis.

iSC> **status sri**

5 satellites tracked

ID	Mode	S/N
2	8	41
18	0	116
19	8	55
27	8	86
28	8	68
31	8	74

Latitude N 42 deg 4 min 2.461 sec

Longitude W 88 deg 2 min 59.447 sec

Altitude 401.9 feet above sea level

Date/Time 6/10/1995 1 5:30:00 GMT

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7

System Troubleshooting

Chapter overview

This chapter provides troubleshooting procedures for the system.

The topics of this chapter are listed in the following table.

Troubleshooting

The fault indications identified in this chapter provide a guide for isolating failures to a Field Replaceable Unit (FRU). The service technician should perform troubleshooting whenever a failure occurs during normal operation that cannot be resolved by the Operations and Maintenance Center (OMC).

Some indications list several possible failures along with corresponding corrective actions. If a failure is isolated to the FRU level, the suspected module should be replaced with a new one. This restore the system to normal operation as quickly as possible.

Suspected FRUs should be shipped to a Motorola repair depot for repair.

Controller

Table 7-1 ***Hardware failures***

Indication	Possible failure	Corrective action
The circuit breaker on the Cabinet for the appropriate system is set on, but the Power On LED (green) on the Controller is not lit.	no power connected to the Controller	• Check power source.
	cabling	• Check power cabling to Controller replace cable if necessary.
Controller can't communicate over Ethernet (example: No BRCs show up at OMC).	ELP	• Switch to standby Controller/ELP.
	T1/E1 is not on line	• Verify T1/E1 is on line.
	open T1/E1 cable	• Check cabling from T1/E1 Transient card to Smartjack.
Power On LED is not lit on the Controller.	no power to the Controller	• Verify the proper breaker is set to ON.
		• Verify power wiring harness to Controller.
		• If breaker is set to ON, verify -40 to -60 Vdc at Controller power connector.
	Power Supply	• If power is present at connector, replace Power Supply.
Controller can't communicate on T1/E1.	STP/SEP or T1/E1 Transient	• Replace STP/SEP.
		• If still fails, replace T1/E1 Transient.
	Power Supply	• Verify Power On LED is lit on Controller. If not, check power connections to the Controller.
Controller failure with time.	Controller fan	• Check fan operation, make sure fan is not obstructed or blocked. Replace if necessary.
Serial or Ethernet download fails.	incorrect computer setup for download	• Configure correct computer setup and perform download again.

Controller

Table 7-2 ***Subrated T1 PCI (STP) card failures***

Indication	Possible failure	Corrective action
Yellow Alarm LED is lit.	Controller is receiving an alarm from the far end.	• Check for proper operation of external site equipment. • Notify the far end.
Red Alarm LED is lit.	Controller is in an out of frame condition.	• Check T1/E1 line with a T1/E1 tester.
AIS LED is lit.	Far end equipment /Telco.	***NOTE:*** AIS LED lights when the all ones keep alive signal is received. • Check for proper operation of external site equipment. • Notify the far end.
BPV LED is lit.	Controller has received a Bipolar Violation (BPV) from the network.	• For T1/E1, check all connections between iSC and Network Interface. • Telco may not have T1 line optioned for B8ZS • Run BERT test with B8ZS on T1 line with T1 tester.
CRC Error LED is lit.	Controller has received a CRC error from the network.	• Check T1/E1 line with a T1/E1 tester. • Notify the Telco.

Table 7-2 ***Subrated T1 PCI (STP) card failures — continued***

Indication	Possible failure	Corrective action
LOS LED is lit.	Loss of T1/E1 signal.	• Check network connection at Controller rear. • Verify Controller in question is on line (green On line LED is lit).
	Controller did not boot up or run T1/E1 driver software.	• Reset the Controller and reboot.
	Lightning arrestor	• Bypass or replace lightning arrestor and verify that the LOS LED is not lit.
	T1/E1 line	• Use T1/E1 tester to verify the proper T1/E1 signal is entering the Controller. • Monitor T1/E1 at the front panel and verify T1/E1 Transient protection card is OK.
	T1/E1 Transient protection card	• Replace T1/E1 Transient protection card
	STP/SEP	• Replace STP/SEP card.
Network Loop LED is lit	The STP/SEP has received an in-band or out-of-band loopback code and is in loopback mode.	• Notify the far end.
Local Loop LED is lit	Front panel switch has put the STP/SEP in loopback mode.	• Push the Controller Loop pushbutton switch to take unit out of loopback.
Keep Alive LED is lit	Controller is in bootup mode; STP/SEP card is transmitting framed all ones pattern to the network.	• Make sure the Controller completes the bootup procedure before proceeding to Controller troubleshooting.

Table 7-3 ***Site Reference ISA (SRI) card failures***

Indication	Possible failure	Corrective action
The circuit breaker on the Cabinet breaker panel is on, but Reference Status On Line LED (green) on the Controller is not lit.	No power connected to the Controller.	• Check power source.
	cabling	• Check power cabling to Controller, replace cable if necessary.
ping sri MMI command response: SRI has an alarm status.	SRI hardware	• Replace SRI.
ping sri MMI command response: 1PPS is not available.	SRI hardware	• Replace SRI.
ping sri MMI command response: Satellite tracking is not adequate.	SRI, antenna, antenna cabling, surge arrestors, or RFI	• Use status sri MMI command to determine GPSR status.
status sri MMI command response: Satellite tracking mode on all 6 channels are less than 8.	antenna, cables, surge arrestors, SRI, RFI	• Check antenna, cables, and surge arrestors before replacing SRI.
		• If antenna installation is OK, suspect intermodulation desensitizing.
status sri MMI command response: Signal strength numbers of satellites of mode 8 are less than 20.	antenna, cables, surge arrestors, SRI, RFI	• Check antenna, cables, and surge arrestor before replacing SRI.
		• If antenna installation is OK, suspect intermodulation desensitizing.

Table 7-3 ***Site Reference ISA (SRI) card failures — continued***

Indication	Possible failure	Corrective action
ping sri MMI command response: No satellites tracked.	open or damaged GPS antenna, lead-in, or surge arrestor	• Verify GPS antenna, lead-in, and surge arrestor.
Slow handovers.	open or damaged GPS antenna, lead-in, or surge arrestor	• Verify GPS antenna, lead-in, and surge arrestor.
	open 5 MHz cable or missing termination of 5 MHz cable	• Check for open 5 MHz cable and missing termination of 5 MHz cable.
Watchdog LED is lit	Controller watchdog	***NOTE:*** The watchdog timer is on the SRI card. • If SRI indications are OK, reset the Controller by pressing the Controller CPU Reset switch. • Go to SRI troubleshooting.
	Controller fails to boot up properly	• Reset the Controller by pressing the Controller CPU Reset switch. • If the LED does not go out, replace the Controller.

Table 7-4 ***Controller Command Responses***

Symptom	Possible failure	Corrective action
MMI command response: Subrated T1 PCI Card is UNAVAILABLE.	STP	• Replace STP.
MMI command response: Site Reference ISA is UNAVAILABLE.	GPS Receiver (GPSR) has not been allowed enough time to track	• Allow GPSR 25 minutes to track. If not OK, replace SRI.
	GPS antenna or antenna connections	• Verify the GPS antenna, cabling, and connections. Repair or replace as necessary.
	SRI or associated cabling	• Check cables, terminations, and LEDs of SRI.

Table 7-4 ***Controller Command Responses — continued***

Symptom	Possible failure	Corrective action
MMI command response: 1PPS is UNAVAILABLE.	SRI or associated cabling	• Check cables, terminations, and LEDs of SRI.
	GPS receiver failure	• Execute the **ping sri** to make sure the GPS receiver is receiving satellite signals. If still fails, replace SRI.
MMI command response: ROM checksum test performed UNSUCCESSFULLY.	Power PC 603e failure	• Replace PowerPC 603E motherboard.
MMI command response: RAM checksum test performed UNSUCCESSFULLY.	PowerPC 603e	• Replace PowerPC 603E motherboard.
MMI command response: Correlation test for channels performed UNSUCCESSFULLY.	GPS Receiver (GPSR)	• Execute **status sri** to ensure GPS receiver is receiving satellite signals. Refer to **ping sri** response indications. • Replace SRI.
MMI command response: Satellite tracking is NOT ADEQUATE.	GPSR has not been allowed enough time to track.	• Allow GPSR ~25 minutes to track. If not OK, replace SRI.
	GPS antenna or antenna connections	• Verify the GPS antenna, cabling, and connections. Repair or replace as necessary. • Execute the **status sri** to ensure the GPS receiver is receiving satellite signals. Refer to **ping sri** response indications.

iDEN Monitor Unit

Table 7-5 ***iMU troubleshooting***

Indication	Possible failure	Corrective action
EAS/IMU breaker on Cabinet breaker is on, but POWER LED (green) on iMU is not lit.	No power connected to iMU.	• Check power source.
	cabling	• Check power cabling to iMU; replace cable if necessary.
Wrong iMU response.	miswired modular cable	• Check iMU modular cabling.
AC fail alarm.	AC input, or an open or disconnected alarm lead	• Verify AC input, check for open or disconnected alarm leads.
High temperature alarm.	AC input to air conditioner	• Verify AC input.
	site air conditioner	• Call for service on air conditioner.
	Alarm sensor improperly set or wires shorted.	• Check and adjust alarm sensor.
	Alarm sensor located in a hot spot.	• Check and adjust alarm sensor.
Low temperature alarm.	Air conditioner does not shut off.	• Repair HVAC.
	Thermostat is set too low.	• Set thermostat to 78° F.
	Cold air blowing on alarm sensor.	• Shield or relocate sensor.
Can’t complete radio call from BMR.	open or damaged BMR antenna, cabling, or surge arrestors	• Verify no open or damage to BMR antenna, lead-in, or surge arrestors.
Poor quality BMR call on all channels.	open or damaged BMR antenna, cabling, or surge arrestors	• Verify no open or damage to BMR antenna, lead-in, or surge arrestors.

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8

Software Commands

Chapter overview

This chapter provides definitions for the Man-Machine Interface (MMI) commands. MMI commands are used to test and configure the system equipment via a service computer.

The following table lists the chapter topics.

Section	Page	This section . . .
MMI Commands	8-2	describes the MMI commands, including access levels, and conventions
iSC Commands	8-4	defines the iSC command set which is used to configure and test the iSC

MMI Commands

MMI commands are input from a service computer to the system RS-232 serial port (19200 bps, 8 data bits, 1 stop bit, no parity). The RS-232 port is accessed from the iSC Service Access connector.

The service technician enters the MMI commands to communicate with the iSC at the system level. The system response is returned to the service computer via RS-232.

The appropriate test procedures use these commands to test and configure the system. The test procedure for the iSC appears in the System Testing chapter of this manual and the test procedure for the BR appears in the *EBTS System Manual (68P81099E10) Base Radio* chapter.

Access Level

The iSC commands are available through the use of the password: **motorola**. This password allows the service technician access to a subset of the MMI command set. This subset is used for field service and does not allow permanent configuration of the iSC.

Note: The **motorola** password is a default password that is programmed during manufacturing. The password may be changed by the Operations and Maintenance Center (OMC).

Conventions

The syntax for each command is presented as follows:

- plain text shows the actual text to be typed to invoke a command or action
- *italic* text shows where a parameter or value is to be substituted
- text enclosed in brackets [ ] indicates an optional value that may be entered.
- Where items are separated by vertical bars | , the items are the applicable choices that may be entered
- text enclosed in braces { } indicates a corresponding selection or parameter that **must** be entered for the command to execute

The syntax for the iSC commands is case sensitive. Each example is shown in the format that should be entered by the operator.

Some commands require the use of parameters. If input parameters are not entered, a response is returned identifying the proper syntax for the command.

A definition describes in detail each command's purpose and function. The definition is followed by an example of the commands response. Typical values have been used whenever possible.

Some commands return varying responses (such as available, not available, unknown, o.k., and alarm). Only one of the possible responses is listed in each example.

iSC Commands

CAUTION

The following commands should be executed only under the strict procedure for downloading the iSC diagnostic software, outlined in the System Testing chapter. Use of these commands under other circumstances may result in damage to the iSC. These commands have been released only for the specific purpose of improving code download reliability.

- **creat**
- **dl**
- **probe**
- **rm**

Note: Where commands listed below specify multiple E1 or T1 interfaces, the multiple choices apply to the multiple interfaces used with the High Capacity iSC (HCiSC). On systems using a standard iSC, disregard choice option; default with no option entered will work with standard iSC.

DELOOP E1

Syntax:

deloop e1 {*1* | *2*}

This command sets the specified iSC E1 interface (either card 1 or 2, as shown above) to normal mode from loopback mode. This command is used only with an E1 test box.

Example:

iSC> **deloop e1 1**
E1 interface 1 returned to normal mode

DELOOP T1

Syntax:

deloop t1 {*1* | *2*}

This command sets the specified iSC T1 interface (either card 1 or 2, as shown above) to normal mode from loopback mode. This command is used only with a T1 test box.

Example:

iSC> **deloop t1 1**
T1 interface 1 returned to normal mode

DISPLAY EAS

Syntax:

display eas

This command returns the status of the inputs and outputs for the iDEN Monitor Unit (iMU). A list of site alarms is displayed, including the current status for inputs (*ok/alarm*) and for outputs *(active/inactive)*.

Example:

DISPLAY SEP

Syntax:

display sep

This command returns availability information on all of the Subrated E1 PCI (SEP) cards installed in the iSC

Example:

iSC>**display sep**

Subrated E1 PCI Card 1	Available
Subrated E1 PCI Card 2	Available

iSC Commands

iSC>**display eas**

CODE	DESCRIPTION	
237	Control cabinet circuit breaker	o.k.
233	RF cabinet 1 circuit breaker	o.k.
234	RF cabinet 1 combiner/multicoupler Amplifier	o.k.
235	RF cabinet 1 combiner/multicoupler power supply	o.k.
228	RF cabinet 3 tower top amplifier	o.k.
238	RF cabinet 1 PCCH Redundancy Control Output	inactive
229	RF cabinet 2 circuit breaker	o.k.
230	RF cabinet 2 combiner/multicoupler Amplifier	o.k.
231	RF cabinet 2 combiner/multicoupler power supply	o.k.
236	RF cabinet 1 tower top amplifier	o.k.
239	RF cabinet 2 PCCH Redundancy Control Output	inactive
225	RF cabinet 3 circuit breaker	o.k.
226	RF cabinet 3 combiner/multicoupler Amplifier	o.k.
227	RF cabinet 3 combiner/multicoupler power supply	o.k.
232	RF cabinet 2 tower top amplifier	o.k.
240	RF cabinet 3 PCCH Redundancy Control Output	inactive
245	Power system breaker fail	o.k.
246	Rectifier Module Fail (minor)	o.k.
247	Rectifier Module Fail (major)	o.k.
243	Low Voltage	o.k.
244	High Voltage	o.k.
242	AC Power Failure	o.k.
219	Site Entry	o.k.
220	Site High Ambient Temperature	o.k.
221	Site Low Ambient Temperature	o.k.
222	Site Smoke Detector	o.k.
223	Site AC Surge Protector	o.k.
224	System use	o.k.
207	Customer input	o.k.
208	Customer input	o.k.
211	Customer input	o.k.
212	Customer input	o.k.
213	Customer input	o.k.
214	Customer input	o.k.
215	Customer input	o.k.
216	Customer input	o.k.
217	Customer input	o.k.
218	Customer input	o.k.
248	Generator remote start	inactive

DISPLAY STP

Syntax:

display stp

This command returns availability information on all of the Subrated T1 PCI (STP) cards installed in the iSC.

Example:

```
iSC>display stp
Subrated T1 PCI Card 1          Available
Subrated T1 PCI Card 2          Available
```

DISPLAY SRI ALARMS

Syntax:

display sri alarms

This command returns the current status of the alarms relating to the Site Reference ISA (SRI) card, the on-line and alarm status for the SRI, satellite tracking performance, and the availability of the 1PPS signal.

Example:

iSC>**display sri alarms**	
Site Reference ISA	on line
alarm status	ok
Satellite tracking	adequate
1 PPS	available

- A response of ON LINE is returned when the SRI is powered up and active.
- A response of OFF LINE is returned for the standby SRI (with power applied).
- A response of UNKNOWN indicates the device may not be working properly or is not connected.

  Note: If UNKNOWN is displayed, try the **display sri alarms** command again.

- If Satellite tracking is NOT ADEQUATE, a problem with the GPS antenna(s)/receiver(s) is indicated.

HELP

Syntax:

help

This command returns a list of valid MMI commands for the iSC command set. Each command is described within this chapter.

Example:

```
iSC> help
deloop e1 <card #>
deloop t1 <card #>
display eas
display stp
display sep
display sri alarms
loop e1 <card #>
loop t1 <card #>
outport <port#> <data>
ping bmr
ping br <br#>
ping br all
ping br table
ping standby isc
ping sri
status sri
switch isc
whois isc
rf output# <output#> <active | deactive>
whois br all
whois br <br#>
monitor <locked | gps | alternate | external | reference | 5 MHz>
ver
```

LOOP E1

Syntax:

loop e1 {*1* | *2*}

This command sets the specified iSC E1 interface (either card 1 or 2, as shown above) into a loopback mode allowing an E1 tester to verify the E1 wiring within the Cabinet. This command is used only with an E1 test box.

Example:

iSC>**loop e1 1**
E1 interface 1 in loopback mode

LOOP T1

Syntax:

loop t1 {*1* | *2*}

This command sets the specified iSC T1 interface (either card 1 or 2, as shown above) into a loopback mode allowing a T1 tester to verify the T1 wiring within the Cabinet. This command is used only with a T1 test box.

Example:

iSC>**loop t1 2**
T1 interface 2 in loopback mode

MONITOR

Syntax:

monitor [locked | gps | alternate | external | reference |5 MHz]

This command routes the selected signal to the front panel monitor port (**MON** connector).

Example:

iSC>**monitor**
SRI signal monitor commands:

monitor locked	-- Locked 1pps
monitor gps	-- GPS 1pps
monitor alternate	-- 1pps from redundant CPU tray
monitor external	-- External 1pps
monitor reference	-- External Reference
monitor 5Mhz	-- 5Mhz clock (default)

OUTPORT

Syntax:

outport {*port #*} {*text string*}

This command sends a string of text to a specified serial port. Valid port numbers are 0 through 3.

Port 0 is console

Port 1 is not used

Port 2 is BMR

Port 3 is GPS

The data consists of ASCII characters.

Note: Do not send text to a serial port unless an appropriate device has been connected which will receive the text.

Example:

In this example, the text string *Enhanced Transceiver* is sent to port 2. The output of port 2 should contain the same text string.

```
iSC>outport 2 Enhanced Transceiver
```

PING BMR

Syntax:

ping bmr

This command returns the Base Monitor Radio (BMR) software version number.

Example:

```
iSC>ping bmr
BMR Software 00.03.05
```

PING BR

Syntax:

ping br [11-16| 21-26 |... | 81-86 | all]

This command returns the availability of the selected BR, 1PPS signal, 5 MHz signal, the current transmit and receive frequencies, and if the transmitter is currently keyed.

Note: The first digit in the variable represents the cabinet position. The second digit in the variable represents the BR position within a selected cabinet.

Example:

iSC>**ping br 11**

Base Radio 11	available
1 PPS	available
5 MHz	available
TX Frequency	XX MHz
TX keyed	on
RX Frequency	XX MHz

An unsuccessful response from the BR returns NOT SUCCESSFUL if an Ethernet time-out occurs while awaiting a response, as shown below. The Ethernet connection to the BR should be checked on an unsuccessful ping.

iSC>**ping br 23**
Ping br 23 is not successful

PING BR TABLE

Syntax:

ping br table

This command lists a table of all BRs that are registered with the iSC. The current status of the 1PPS signal, the 5 MHz signal, the current transmit and receive frequencies, and if the transmitter is currently keyed are also given.

If a BR is not registered with the iSC, a row of hyphens is displayed for the status of that BR.

Example:

iSC>**ping br table**

BR#	1PPS	5MHz	TxFreq	TxKeyed	RxFreq
11	yes	yes	851.66250	no	806.66250
12	---	---	---------	---	---------
13	---	---	---------	---	---------
14	---	---	---------	---	---------
15	---	---	---------	---	---------
16	---	---	---------	---	---------
21	no	yes	866.38750	no	821.38750
22	---	---	---------	---	---------
23	---	---	---------	---	---------
24	---	---	---------	---	---------
25	---	---	---------	---	---------
26	---	---	---------	---	---------
31	yes	yes	856.36250	no	811.36250
32	---	---	---------	---	---------
33	---	---	---------	---	---------
34	---	---	---------	---	---------
35	---	---	---------	---	---------
36	---	---	---------	---	---------

.
.
.

PING STANDBY iSC

Syntax:

ping standby isc

This command returns information relating to the standby iSC and its FRUs. The availability of the iSC including the STP, Serial/Parallel Transients, and the SRI is displayed.

An unsuccessful response returns NOT AVAILABLE if an Ethernet time-out occurs while awaiting a response. The example below shows a successful response. The Ethernet connection to the iSC should be checked on an unsuccessful ping.

Example:

iSC>**ping standby isc**

Standby iSC is	available
Subrated T1 PCI Card 1	available
Serial/Parallel Transient transition module	available
Standby SRI is	available

PING SRI

Syntax:

ping sri

This command returns information on the SRI.

Example:

```
iSC>ping sri
Site Reference ISA          on line
alarm status                OK
Satellite tracking          adequate
1 PPS                       available
```

- A response of ON-LINE is returned when the SRI is active.
- A response of OFF LINE is returned for the standby SRI.
- A response of UNKNOWN indicates the device is not working properly.
- If Satellite tracking is NOT ADEQUATE, a problem with the GPS antenna(s)/receiver(s) is indicated.

STATUS SRI

Syntax:

status sri

This command returns GPS tracking information reported by the SRI.

Example:

```
iSC>status sri
5 satellites tracked
   ID  Mode   S/N
    2    8    41
   18    0   116
   19    8    55
   27    8    86
   28    8    68
   31    8    74
Latitude    N 42 deg 4 min 2.461 sec
Longitude   W 88 deg 2 min 59.447 sec
Altitude    401.0 feet above sea level
Date/Time   06/16/1993  15:30:57 GMT
```

SWITCH iSC

Syntax:

switch isc

This command switches control from the active Controller to the standby Controller.

Example:

On a successful switch, a message is returned indicating that the switch was accomplished and that the service computer must switch to the new Controller to continue.

```
iSC>switch iSC
switch iSC accomplished, please switch your service terminal to the newly
activated iSC to continue with your diagnostics.
```

On an unsuccessful attempt, a message giving the reason why the switch was not accomplished is displayed.

iSC>**switch iSC**
switch iSC cannot be accomplished due to alarms on the standby iSC.

TEST

Syntax:

test

This command executes a self-test of the active Controller. A message is first returned asking whether the long form response is desired. This command may only be entered once after starting code or after reset.

The first example lists the response for the short form.

Example:

iSC>**test**

Do you wish long form? (Yes/No) **no**
integrated Site Controller

Atlas PowerPC 603e processor module	available
Subrated T1 PCI Card	available
Site Reference ISA	available
iMU Status	O.K.
Ethernet	available
T1 communications	O.K.
Base Monitor Radio (iMU)	available

In the long form response, other checks are performed in addition to those of the short form. The response of the long form is provided below.

iSC>**test**

Do you wish long form? (Yes/No) **yes**
integrated Site Controller

Atlas PowerPC 603e processor module	available
Subrated T1 PCI Card	available
Site Reference ISA	available
1 Pulse Per Second	available
ROM checksum test performed	successfully
RAM checksum test performed	successfully
Correlation test for the channels performed	successfully
Satellite tracking	adequate
Environmental Alarm Unit (iMU) Status	OK
Ethernet	available
A self test to check the internal logic has been performed	successfully
A time domain reflectory has been performed	successfully
A loopback test has been performed	successfully
T1 communications	OK

VER

Syntax:

ver

This command returns the current version number of the iSC software.

Example:

iSC>**ver**
iSC Factory Install D02.00.03 - Install

WHOIS iSC

Syntax:

whois isc

This command returns the iSC status and Ethernet address for the active and standby iSCs.

Example:

iSC>**whois isc**
iSC active Ethernet address 08:00:3e:21:9b:5c
iSC standby Ethernet address 08:00:3e:21:9b:5e
You are connected to the active iSC.

WHOIS BR

Syntax:

whois br [11-16 | 21-26 |... | 81-86 | all]

This command returns the Ethernet address for the selected BR.

The first digit in the variable represents the cabinet position. The second digit in the variable represents the BR position within a selected cabinet.

Example:

When ALL BRs are selected, the Ethernet address is returned for all BRs in the system. If a BR is not registered with the iSC, an Ethernet address of 00:00:00:00:00:00 is returned.

```
iSC>whois br all
BR cabinet 1 position 1 Ethernet address 00:00:00:00:00:00
BR cabinet 1 position 2 Ethernet address 00:00:00:00:00:00
BR cabinet 1 position 3 Ethernet address 00:00:00:00:00:00
BR cabinet 1 position 4 Ethernet address 00:00:00:00:00:00
BR cabinet 1 position 5 Ethernet address 00:00:00:00:00:00
BR cabinet 2 position 1 Ethernet address 00:00:00:00:00:00
BR cabinet 2 position 2 Ethernet address 00:00:00:00:00:00
BR cabinet 2 position 3 Ethernet address 00:00:00:00:00:00
BR cabinet 2 position 4 Ethernet address 00:00:00:00:00:00
BR cabinet 2 position 5 Ethernet address 00:00:00:00:00:00
BR cabinet 3 position 1 Ethernet address 21:00:41:51:61:72
BR cabinet 3 position 2 Ethernet address 00:00:00:00:00:00
BR cabinet 3 position 3 Ethernet address 00:00:00:00:00:00
BR cabinet 3 position 4 Ethernet address 00:00:00:00:00:00
BR cabinet 3 position 5 Ethernet address 00:00:00:00:00:00
.
.
.
```

When a single BR is selected, the Ethernet address is returned for only that BR. In the following example, the Ethernet address is returned only for the BR indicated.

```
iSC>whois br 31
BR cabinet 3 position 1 Ethernet address 21:00:41:51:61:72
```

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Controller

Chapter overview

This chapter provides technical information for the Controller.

The topics of this chapter are listed in the following table.

Controller

Table 9-1 lists the Controller components and the location of more information.

Table 9-1 ***Controller components***

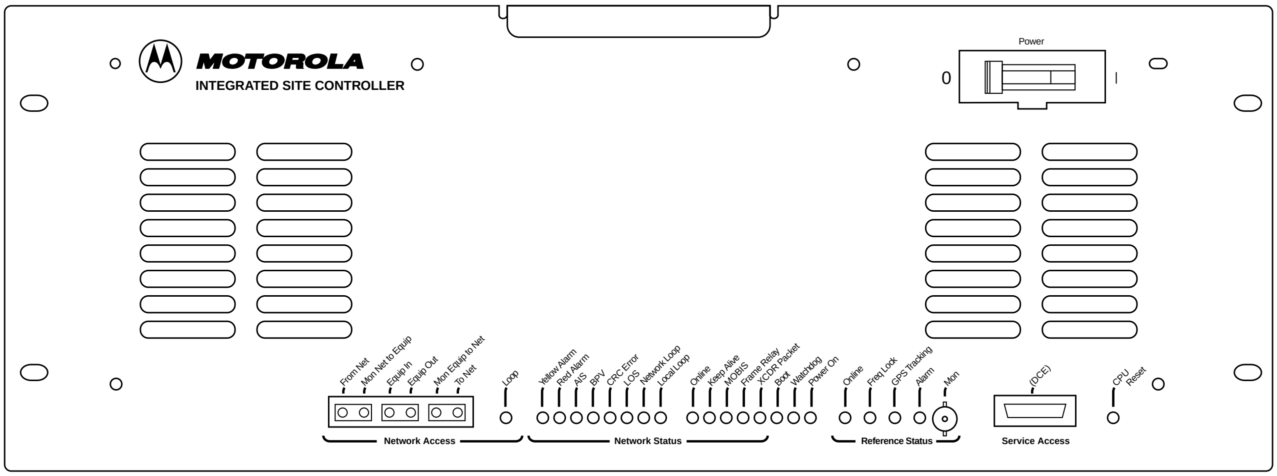
for information on the . . .	go to. . .
Power PC motherboard	page 9-4
Front Panel Display card	page 9-4
Site Reference ISA (SRI) card	Chapter 10 - "Site Reference ISA card"
Subrated T1 PCI (STP) card	Chapter 11 - "Subrated T1 PCI card"
Subrated E1 PCI (SEP) card	Chapter 12 - "Subrated E1 PCI card"
Ethernet LAN PCI (ELP) card	Chapter 13 - "Ethernet LAN PCI card"
T1 and Serial/Parallel (S/P) Transient cards	Chapter 14 - "Transient Protection cards"

The Controller provides:

- an IEEE 1284 port for peripheral applications
- an IEEE 802.3 10base 2 Ethernet connection
- a RS232 port for peripheral applications
- T1 or E1 channelized subrated link
- time reference status indicators
- network access connections
- network status indicators
- a power on/off switch
- a service access port
- a CPU reset switch
- a loop reset switch

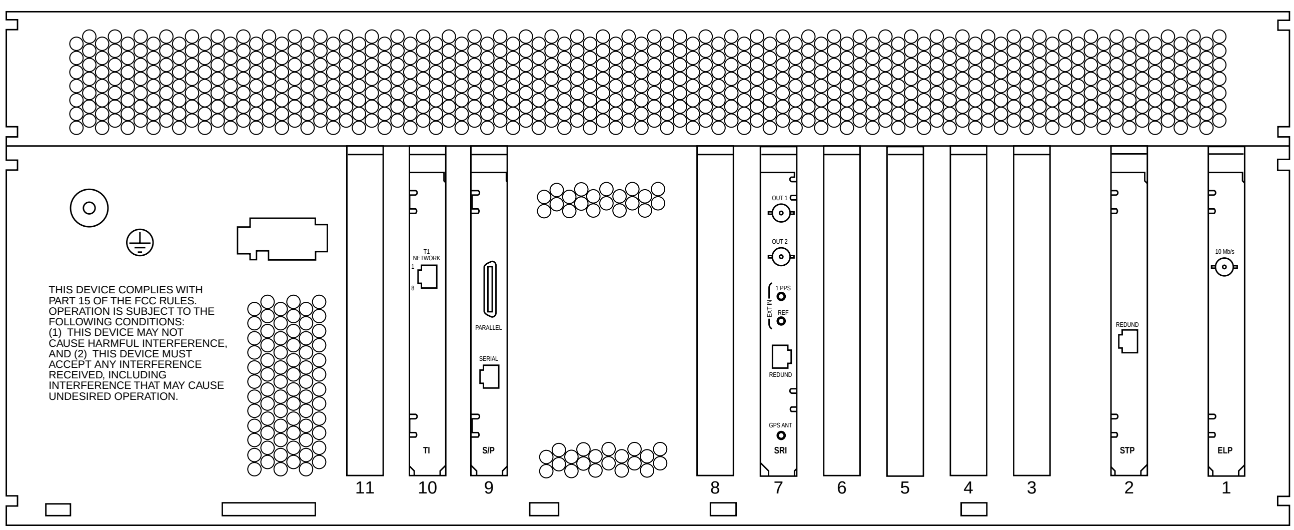
Figure 9-1 and Figure 9-2 show the Controller.

Controller



iSC045
090696JNM

Figure 9-1 ***Controller (front view)***



iSC046
060796SN

Figure 9-2 ***Controller (rear view)***

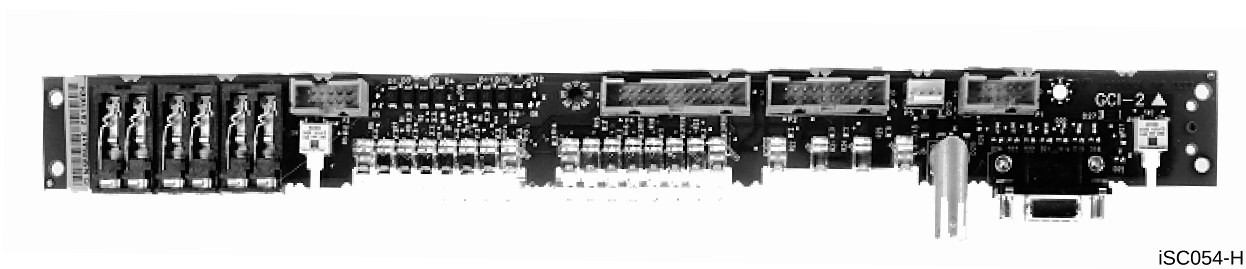
Atlas Power PC motherboard

The Controller uses a Power PC™ motherboard. Slots for PCI and ISA compliant cards are also included. The Power PC CPU, memory, and expansion slots reside on the motherboard.

Memory is provided by commercially available 72-pin SIMMs. The motherboard contains four SIMM sockets for DRAM and can accept up to a total of 128 Mb. The Controller is shipped with two SIMM sockets occupied.

Front Panel Display card

The Front Panel Display card provides connectors for service access and red, yellow, and green LEDs for all of the major sub-systems of the iSC. Figure 9-3 shows the Front Panel Display card.



iSC054-H
052096JNM

Figure 9-3 ***Front Panel Display card***

Indicators

The Front Panel Display card provides a means for monitoring operation of the Controller. Refer to Table 9-2 for the Subrated T1 PCI (STP) card and Subrated E1 PCI (SEP) card network status indications, Table 9-3 for the system status indicators, and Table 9-4 for the Site Reference ISA (SRI) card status indications.

Table 9-2 ***STP Network Status indicators***

Indicator	Color	Description when lit
Yellow Alarm	yellow	Indicates the STP/SEP is receiving an alarm signal from the far end.
Red Alarm	red	Indicates the STP/SEP is in an out-of-frame condition.
AIS	yellow	Indicates the STP/SEP is receiving an Alarm Indication Signal (Keep Alive).
BPV	red	Indicates the STP/SEP has received a Bipolar Violation from the network.
CRC Error	red	Indicates the STP/SEP has received a Cyclic Redundancy Check (CRC) error from the network.
LOS	red	Indicates the STP/SEP is not detecting a T1/E1 carrier on the input.
Network Loop	yellow	Indicates the STP/SEP has received an in-band or out-of-band loopback code and is in loopback mode.
Local Loop	red	Indicates the STP/SEP is in loopback mode via software or the front panel switch.
On-Line	green	Indicates the STP/SEP is on-line and connected to the network.
Keep Alive	red	Indicates the STP/SEP is in a boot-up condition and transmitting a framed all ones pattern to the network.
MOBIS	green	Flashes each time the STP/SEP receives a Mobis or SNMP packet.
Frame Relay	green	Flashes each time the STP/SEP receives a frame relay packet.
XCDR Packet	green	Flashes each time the STP/SEP receives interconnect voice packets from the transcoder.

Table 9-3 ***System status indicators***

Indicator	Color	Description when lit
Boot	green	Indicates the iSC is booting up and running software stored in the motherboard ROM.
Watchdog	red	Indicates the iSC watchdog timer has expired.
Power On	green	Indicates the iSC is powered up.

Table 9-4 ***Site Reference Status indicators***

Indicator	Color	Description when lit
On-line	green	Indicates the SRI card is on-line and providing 5 MHz and 1 PPS to the Base Radios.
Freq Lock	green	Indicates the 5 MHz oscillator is frequency locked to the GPS system.
GPS Tracking	green	Indicates the GPS receiver is tracking GPS satellites.
Alarm	red	Indicates a hardware failure condition is present on the SRI card or improper GPS antenna connection.

Switches

The Controller contains three switches on the front panel:

- **Power** – a toggle switch that applies (position 1) and removes (position 0) power to the Controller
- **CPU Reset** – a pushbutton switch that resets the Controller CPU when pressed
- **Loop** – a pushbutton that initiates network loopbacks when pressed

Performance specifications

Table 9-5 lists the specifications.

Table 9-5 ***Controller performance specifications***

Specifications	Value or range
Input supply voltage range	-40 to -60 VDC
Operating temperature	32˚ to 104˚ F (0 to 40˚ C)
Storage temperature	-40˚ to 185˚ F (-40˚ to 85˚ C)
Humidity	5% to 90% (non-condensing, non-operating) 5% to 80% (non-condensing, operating)

Connectors

The following connectors are located on the front panel:

- **Network Access bantam jacks** – three sets of bantam jacks that provide access for servicing the T1/E1 network
- **Monitor BNC port** – provides access for monitoring the time and frequency signals
- **Service Access DB9 connection** – provides serial port access

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MOTOROLA

10

Site Reference ISA card

Chapter overview

This chapter provides technical information for the Site Reference Industry Standard Architecture (SRI) card.

The topics of this chapter are listed in the following table.

Site Reference ISA card

The SRI (Site Reference ISA) card is a time and frequency reference module that is compatible with the standard ISA type of computer bus. The SRI contains two major components: a high stability oscillator and a GPS receiver. The high stability oscillator provides the frequency reference. The GPS receiver provides the timing reference in addition to tuning the oscillator to eliminate aging and achieve a higher frequency stability than would otherwise be possible.

The frequency reference output is a 5.0 MHz signal with transistor-transistor logic (TTL) compatible voltage levels. The output driver is capable of driving 100 meters of coaxial cable terminated in 50 ohms. When driving long lengths, however, it may be necessary to use a low loss cable such as 1/2” low density foam cable in order to meet the pulse mask at the base radios. The mask is defined and shown in Figure 10-1. For proper operation of the EBTS equipment, it is required that the time/frequency signal at the Base Radios meet the mask as defined below. Figure 10-2 and Figure 10-3 show the SRI.

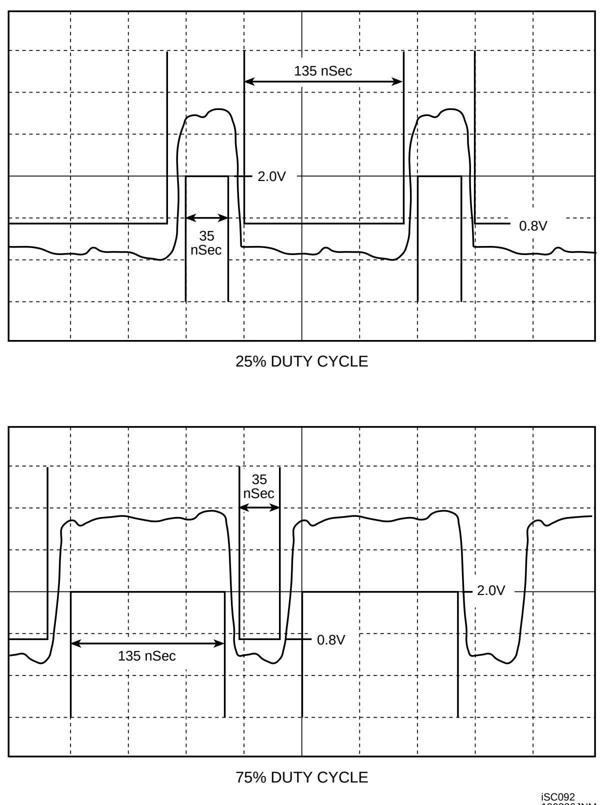

Figure 10-1 ***25% and 75% duty cycle pulse mask***

Site Reference ISA card

Figure 10-2 ***SRI card (top view)***

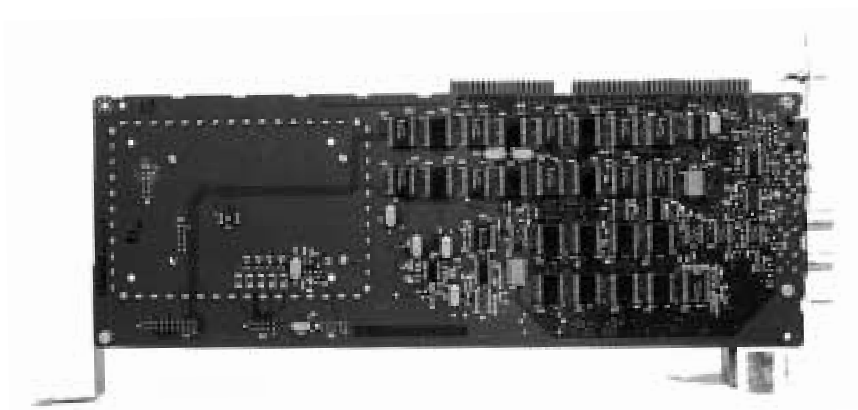

Figure 10-3 ***SRI card (bottom view)***

Indicators

Refer to the Control chapter for a description of the SRI indicators. Figure 10-4 shows the indicators for the SRI.

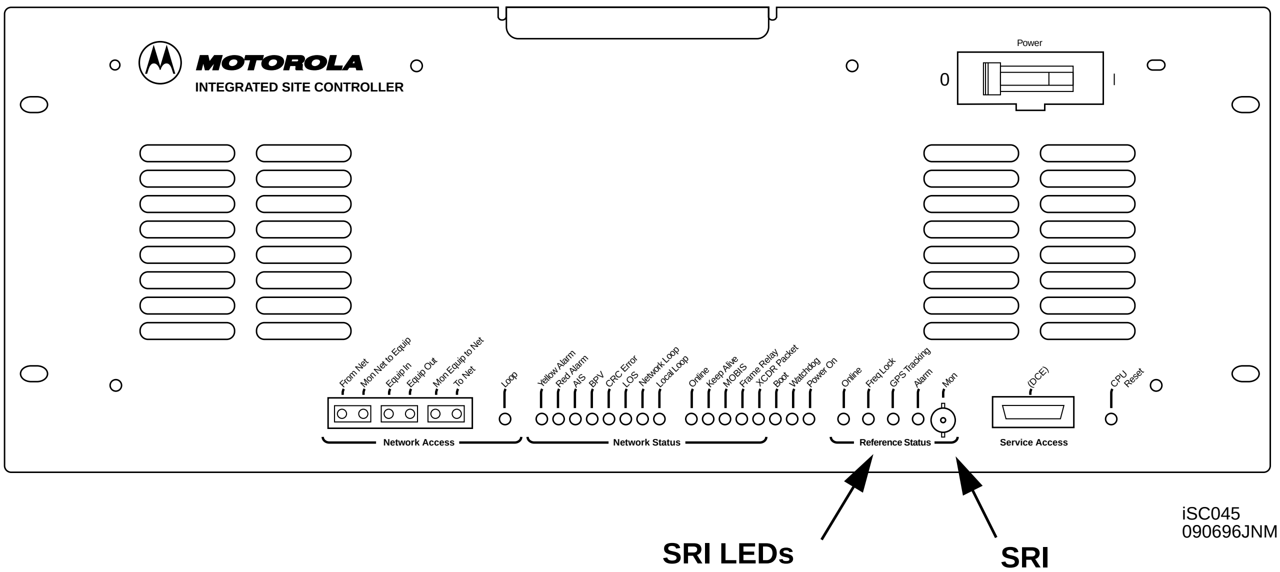

Figure 10-4 ***SRI indicators and connector (front of Controller)***

Performance specifications

Table 10-1 lists the specifications.

Table 10-1 ***SRI performance specifications***

Specification	Value or range
Operating temperature	32° to 104° F (0° to 40° C)
Storage temperature	-40° to 185° F (-40° to 85° C)
Humidity	5% to 95% (non-condensing)
Power consumption	10 Watts typical 20 Watts max. (after warm-up)
5 MHz output: TTL output level Stability	 2.5 Volts into 50 ohm ±7 ppb
Monitor port output level	2.5 V typical
PPS output: Accuracy	 ±1.1 microseconds max.

Theory of operation

The output of the GPS receiver is a 1 pulse per second (1PPS) signal. The digital PLL flywheels the 1PPS so that a failure in the GPSR or GPS System will not cause any large shifts in the timing reference. The output to the BRs is the combined 5MHz/1PPS signal.

To train the oscillator to the GPS, a counter measures the period of the 1PPS signal. A D/A converter warps the High Stability Oscillator (HSO) such that the measured period of 1PPS, over the long term, is exactly one second. A UART accommodates the serial interface of the GPSR on the ISA bus. Refer to Figure 10-5 for a functional block diagram of the SRI.

Site Reference ISA card

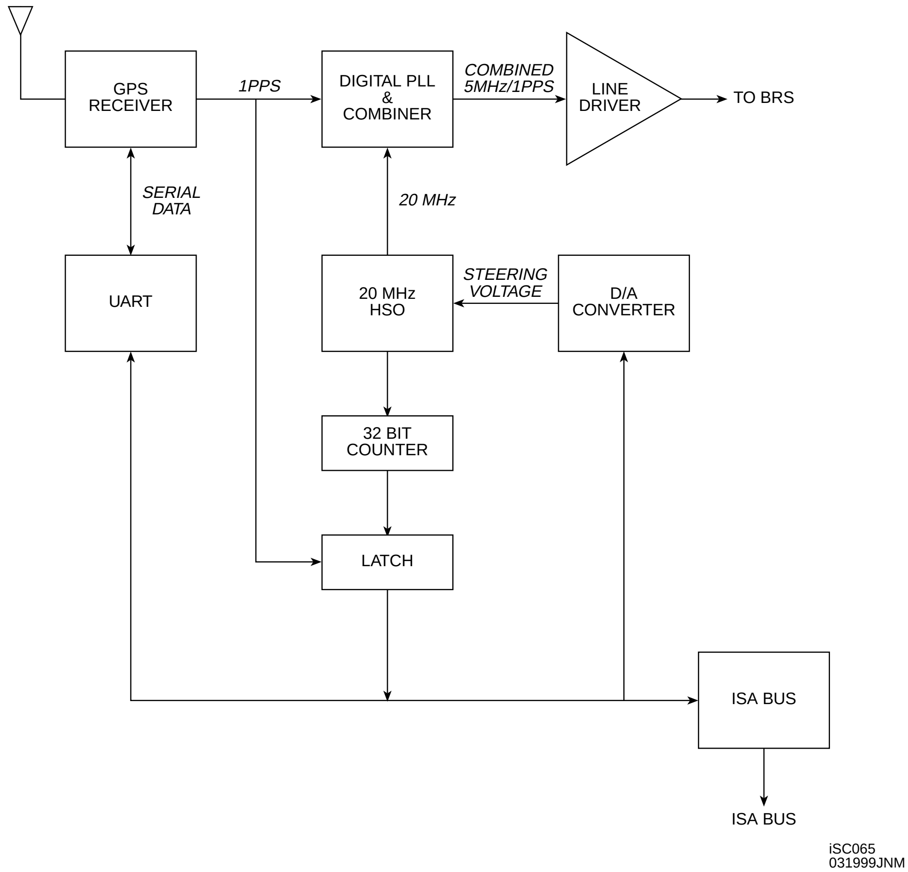

Figure 10-5 ***SRI card block diagram***

Also included, but not shown in the block diagram, are the following:

- external 1PPS and frequency reference inputs which can replace the GPSR and HSO outputs
- interrupt circuitry which generates an interrupt to the host every one second
- logic for determining the lock detect status of the DPLL
- output relay and control circuitry

Combined 5 MHz/1PPS

The combined Time/Frequency is TTL compatible with a 25% or 75% duty cycle output. The varying duty cycle encodes the 1 PPS time reference.

The combined signal is present on the OUT1 and OUT2 connectors. The square wave output has a minimum high level of 2.0 volts and a maximum low level of 0.8 volts. The output can drive up to 20 high impedance (>100 KΩ) loads, spaced a minimum of 0.5 meters apart. Each load must have less than 10 pF capacitance.

Total coaxial cable length must be kept to less than 100 meters and must be terminated with a 50 Ω load.

Time reference

Time reference is provided by a GPSR. The GPSR is a separate module mounted to the SRI board.

Redundancy control

The SRI contains redundancy control circuitry to ensure that only one SRI card transmits onto the time/frequency coaxial cable at any given time. The active/standby switchover is accomplished under software control.

Connectors

The SRI connects easily to other site equipment for quick installation and service. Table 10-2 lists the connectors. Figure 10-6 shows the location of the rear panel connectors. Figure 10-4 shows the location of the front panel connector.

Table 10-2 ***SRI connectors***

Name	Type	Description
Rear panel of Controller		
OUT 1	BNC	provides a 5 MHz/1 PPS output
OUT 2	BNC	provides a redundant 5 MHz/1 PPS output
EXT IN – 1 PPS	SMB	provides an external 1 PPS input
EXT IN – REF	SMB	provides an external reference input
REDUND	RJ48	used for standby control with another SRI

Site Reference ISA card

Table 10-2 ***SRI connectors — continued***

Name	Type	Description
GPS ANT	SMB	provides connection to the GPS antenna
Front panel of Controller		
Monitor	BNC	used to monitor time and frequency signals

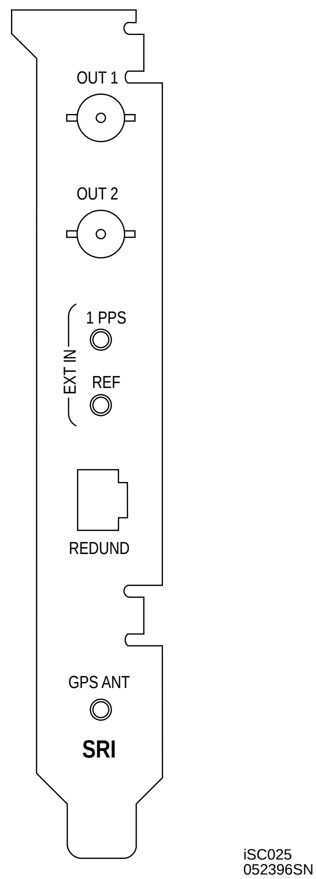

Figure 10-6 ***SRI card (rear view of Controller)***

Redundancy control connector

The RJ48 redundancy control connector is used for standby control with another SRI. The opposite end of the connecting cable plugs into the standby SRI. Only one SRI is active at a time during normal operation. Table 10-3 lists the pinouts.

Table 10-3 ***SRI redundancy control connector pinouts***

Pin	Name	Input/ output	Description
1	1PPS	in	alternate source of 1PPS
2	Control	in	when high, this input forces the SRI off line
3	Force Off	in	when high, this input forces the SRI off line
4	Ground	–	ground
5	Ground	–	ground
6	Force Off	out	when pulses high, this output forces the redundant SRI off line
7	Control	out	when high, this output indicates the SRI is on line
8	1 PPS	out	alternate source of 1PPS

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11

Subrated T1 PCI card

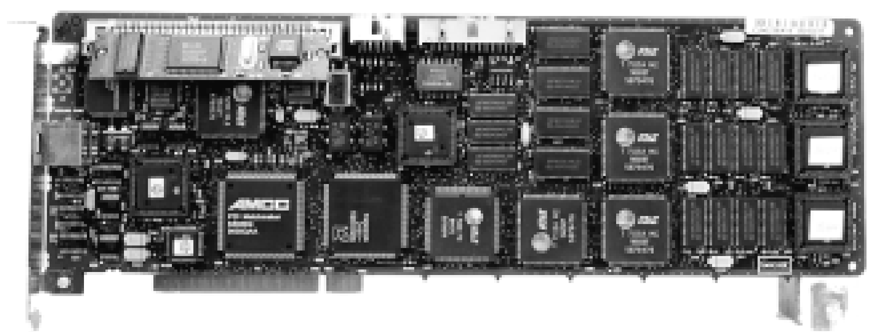
Chapter overview

This chapter provides technical information for the Subrated T1 PCI (STP) card.

The topics of this chapter are listed in the following table.

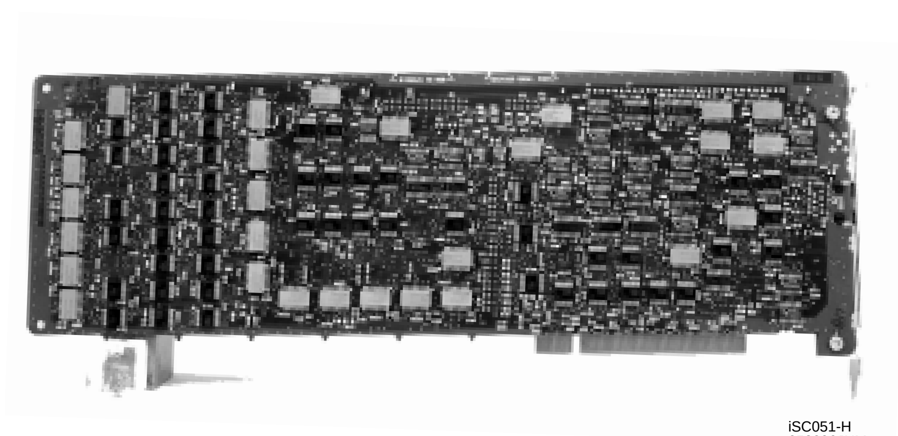
Subrated T1 PCI card

The STP card is a channelized subrated T1 interface card. The T1 card supports 24 channels. Each DSO can be divided into 16 kbs subrates. Each STP card supports a T1 link. Figure 11-1 and Figure 11-2 show the STP.



iSC050-H
052096JNM

Figure 11-1 ***STP (top view)***



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052096JNM

Figure 11-2 ***STP (rear view)***

Indicators

Refer to the Controller chapter for a description of the STP indicators. Figure 11-3 shows the STP indicators on a typical Controller.

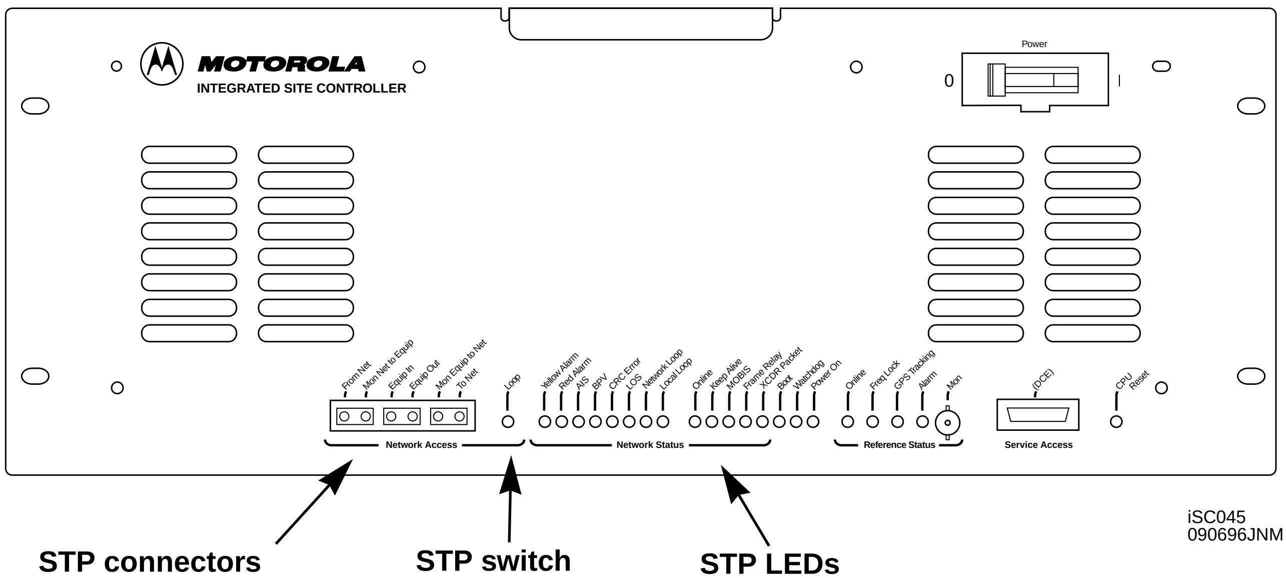
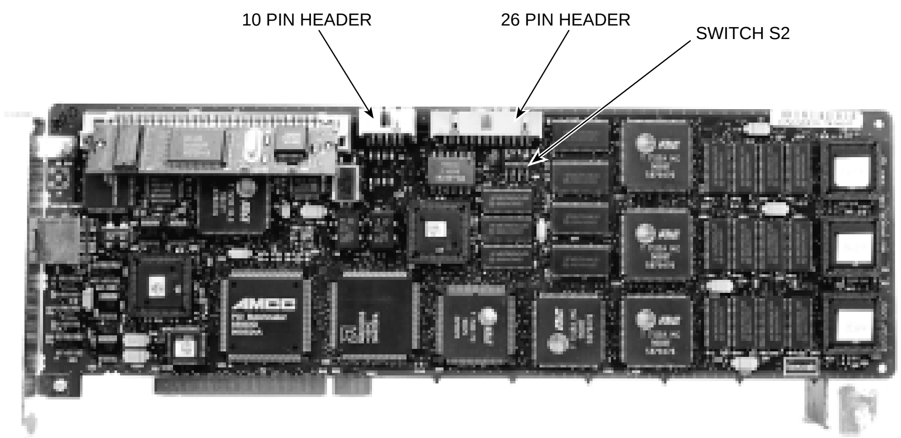


Figure 11-3 ***STP indicators, switch, and connectors (front of Controller)***

Switches

The Loop pushbutton switch initiates a network loopback when pressed. Switch S2, located under the 26 pin header, sets the Line Build-Out for the STP card. Positions 1 and 2 control the signal level. Positions 3 and 4 are not used.

POSITION 1	POSITION 2	OUTPUT
ON	ON	0dB
OFF	ON	-7.5dB
ON	OFF	-15dB
OFF	OFF	-22.5dB



iSC095-H
100696JNM

Performance specifications

Table 11-1 lists the specifications.

Table 11-1 ***STP performance specifications***

Specification	Value or range
Operating temperature	32˚ to 104˚ F (0˚ to 40˚ C)
Storage temperature	-40˚ to 185˚ F (-40˚ to 85˚ C)
Humidity	5% to 95% (non-condensing)
Network interface:	
Line rate	1.544 Mbps loop timed
Framing	ESF
Line code	B8ZS
Connection via T1 Transient card	RJ48 jack, 100Ω
Keep alive	All ones

Theory of operation

The STP card is a 32-bit data width PCI bus slave card that interfaces the system to the Mobile Switching Office (MSO). The STP card contains a PCI controller chip which performs all functions related to interfacing to the PCI bus.

To interface to a T1 line, the STP card contains four HDLC controllers, one LAPD controller, one T1 framer, and a T1 line interface unit. Figure 11-4 shows a functional block diagram of the STP.

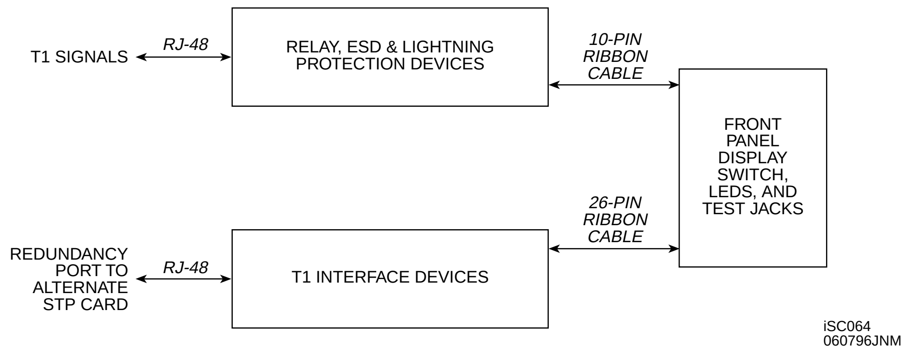


Figure 11-4 ***iSC T1 signal flow***

PCI compatibility

The STP is interfaced to the 33 MHz PCI bus, and is fully PCI compliant. The PCI bus interface is optimized to maximize the data transfer rate across the PCI bus.

Redundancy control

The STP contains redundancy control circuitry to ensure that only one STP card is transmitting data onto the T1 span at any given time. The active/standby switchover is accomplished under software control and the hardware ensures that only one system is active at any given time.

Redundancy connector

Figure 11-5 shows the RJ48 redundancy control connector labeled REDUND. This connector is used for standby control with the STP card in the standby Controller. The opposite end of the connecting cable plugs into its standby STP complement card in the standby Controller. Only the main STP card or its standby complement is active at a given time during normal operation.

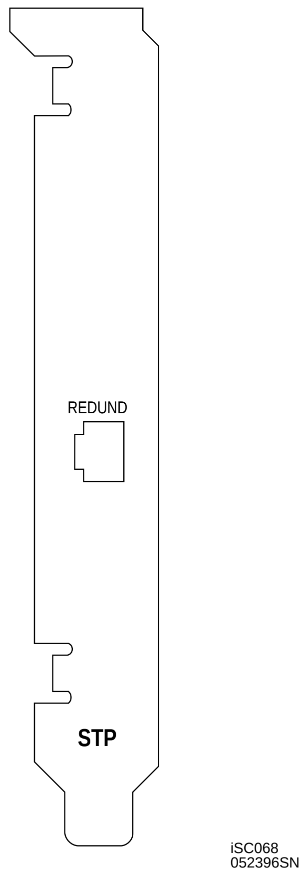


Figure 11-5 ***STP card (rear view of Controller)***

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12

Subrated E1 PCI card

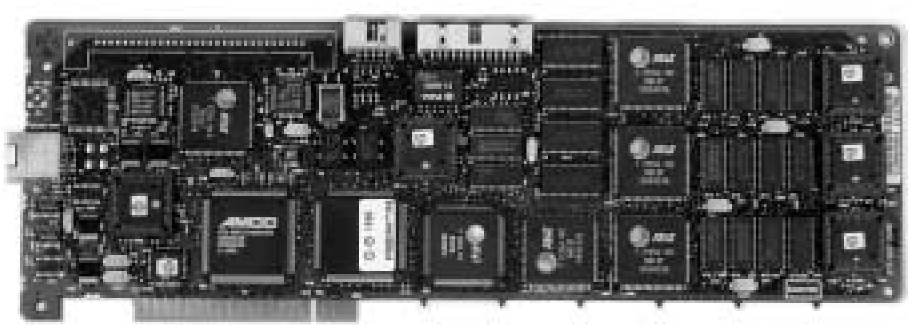
Chapter overview

This chapter provides technical information for the Subrated E1 PCI (SEP) card.

The topics of this chapter are listed in the following table.

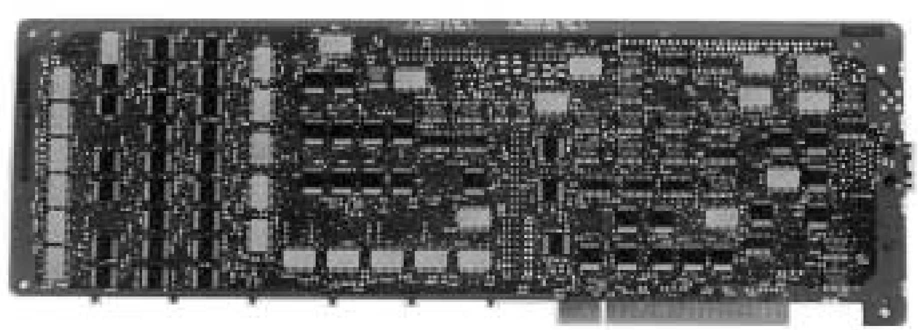
Subrated E1 PCI card

The SEP card is a channelized subrated E1 interface card. The E1 card supports 32 channels. Each DS0 can be divided into 16 kb/s subrates. The SEP card supports an E1 link. Figure 12-1 and Figure 12-2 shows the SEP card.



iSC089-H
100696JNM

Figure 12-1 ***SEP card (top view)***



iSC088-H
093096JNM

Figure 12-2 ***SEP card (bottom view)***

Indicators

Refer to the Controller chapter for a description of the SEP indicators. Figure 12-3 shows the SEP indicators on a typical Controller.

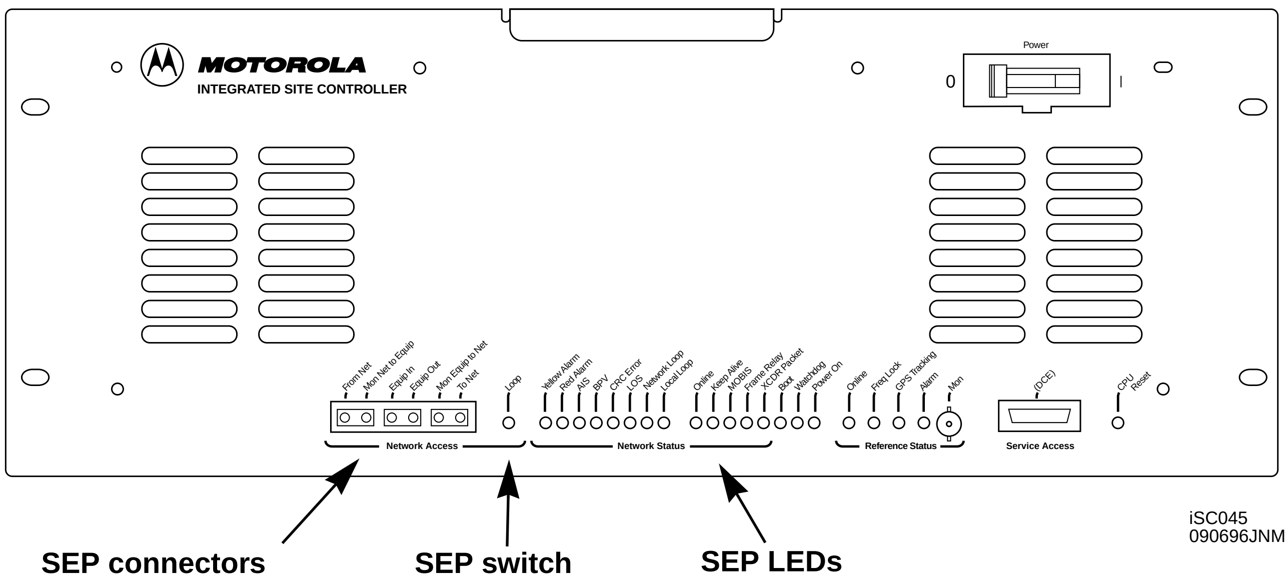
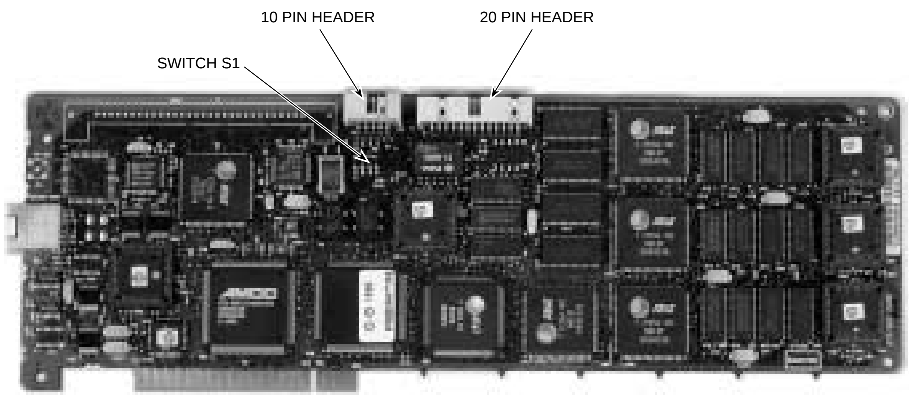


Figure 12-3 ***SEP indicators, switch, and connectors (front of Controller)***

Switches

The Loop pushbutton switch initiates network loopbacks when pressed. Switch S1, located under the 10 pin header, sets the SEP output and input impedance.

POSITION 1	POSITION 2	POSITION 3	POSITION 4	IMPEDANCE
OFF	OFF	OFF	OFF	120Ω
ON	ON	ON	ON	75Ω



iSC094-H
022097JNM

Performance specifications

Table 12-1 lists the specifications.

Table 12-1 ***SEP performance specifications***

Specification	Value or range
Operating temperature	32˚ to 104˚ F (0 to 40˚ C)
Storage temperature	-40˚ to 185˚ F (-40˚ to 85˚ C)
Humidity	5% to 95% (non-condensing)
Network interface:	
Line rate	2.048 Mbps loop timed
Framing	ITU CEPT 2.048 Mbps framing with CRC-4 error checking
Line code	HDB3
Connection via E1 Transient card	DB15 jack, 120Ω or BNC jacks, 75Ω
Keep alive	All ones

Theory of operation

The SEP card is a 32-bit data width PCI bus slave card that interfaces the system to the Mobile Switching Office (MSO). The SEP card contains a PCI controller chip which performs all functions related to interfacing to the PCI bus.

To interface to an E1 line, the SEP card contains four HDLC controllers, one LAPD controller, one E1 framer, and an E1 line interface unit. Figure 12-4 shows a functional block diagram of the SEP.

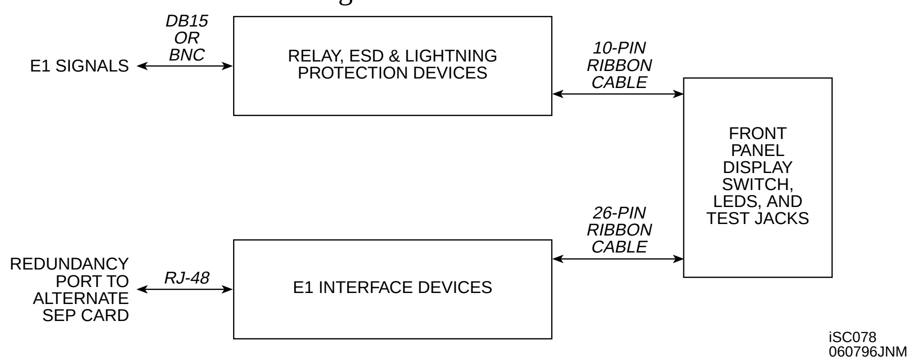


Figure 12-4 ***iSC E1 signal flow***

PCI compatibility

The SEP is interfaced to the 33 MHz PCI bus, and is fully PCI compliant. The PCI bus interface is optimized to maximize the data transfer rate across the PCI bus.

Redundancy control

The SEP contains redundancy control circuitry to ensure that only one SEP card is transmitting data onto the E1 span at any given time. The active/standby switchover is accomplished under software control and the hardware ensures that only one system is active at any given time.

Redundancy connector

Figure 12-5 shows the RJ48 redundancy control connector labeled REDUND. This connector is used for standby control with the SEP card in the standby Controller. The opposite end of the connecting cable plugs into its standby SEP complement card in the standby Controller. Only the main SEP card or its standby complement is active at a given time during normal operation.

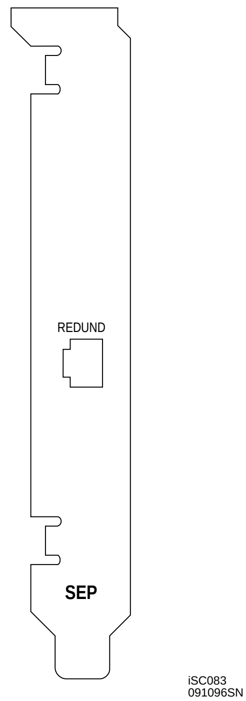


Figure 12-5 ***SEP card (rear view of Controller)***

MOTOROLA

13

Ethernet LAN PCI card

Chapter overview

This chapter provides technical information for the Ethernet LAN PCI (ELP) card.

The topics of this chapter are listed in the following table.

Ethernet LAN PCI card

The Ethernet LAN PCI (ELP) is a PCI Ethernet peripheral board which supports a 10 Mb/s network port.

The ELP provides an efficient method of transferring large amounts of data between different site equipment. Typical ethernet traffic includes the following:

- control information
- compressed voice data
- download code

Figure 13-1 shows the ELP.

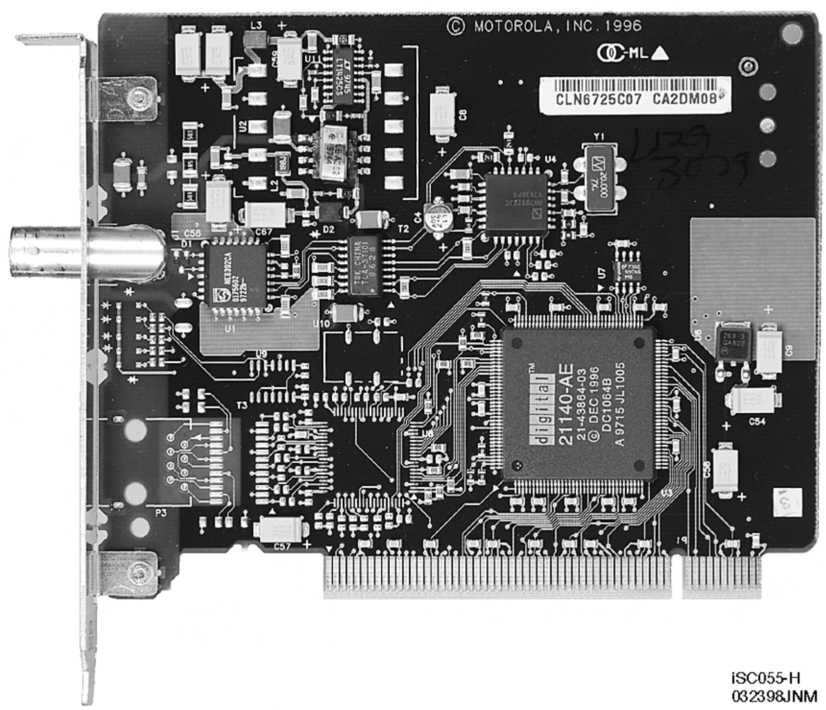


Figure 13-1 ***ELP card***

Performance specifications

Table 13-1 lists the specifications.

Table 13-1 ***ELP performance specifications***

Specifications	Value or range
Operating temperature	32˚ to 104˚ F (0˚ to 40˚ C)
Storage temperature	-40˚ to 185˚ F (-40˚ to 85˚ C)
Humidity	5% to 95% (non-condensing)
Clock speed	25 to 33 MHz
Supply voltages	5V ±5%
PCI 2.1	Compliant

Theory of operation

The ELP contains a fast Ethernet controller (DEC21140) for both 100 Mb/s and 10 Mb/s data rates.

Note: The ELP only supports 10 Mb/s data rate.

The host interface is via the PCI bus local bus. The ELP controller interfaces to the host processor by using on chip command and status registers (CSRs) and a shared host memory area which is set up during initialization. The Controller can support DMA cycles to shared memory; in addition, two large I/O registers allow the ELP controller to minimize processor involvement during normal operation.

The ELP controller provides a conventional 7-wire interface for a 10 Mb/s front end decoder (ENDEC).

A serial ROM stores the ethernet address which is unique to each board.

Figure 13-2 shows a functional block diagram of the ELP.

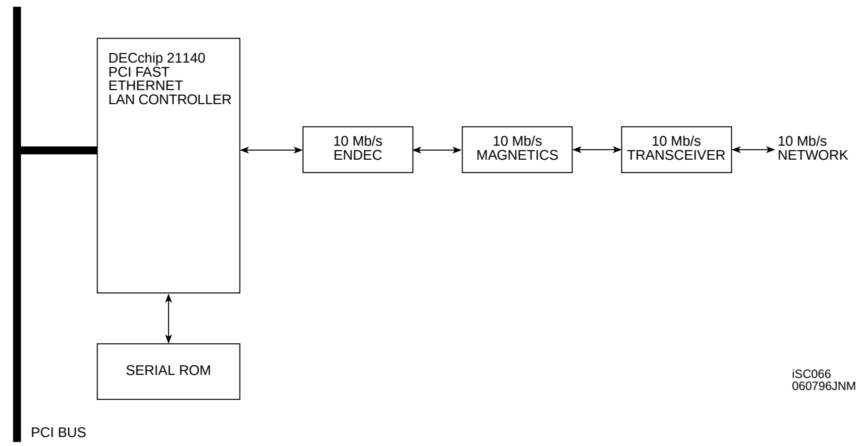


Figure 13-2 ***ELP card block diagram***

Connector

A BNC connector labeled 10 Mb/s is provided on the ELP for connection to the Ethernet. Figure 13-3 shows the connector.

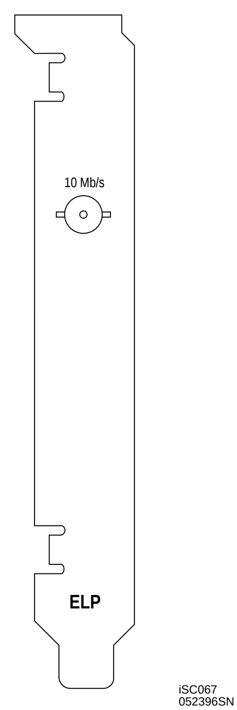


Figure 13-3 ***ELP card (rear view of Controller)***

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14

Transient Protection cards

Chapter overview

This chapter provides technical information for the T1, E1, and Serial/Parallel Transient protection cards.

The topics of this chapter are listed in the following table.

T1 Transient protection card

The T1 is first routed through transient protection circuitry before being processed by the STP. The Transient protection card provides a connection for the T1 and ensures compliance with FCC Part 68 requirements. Figure 14-1 shows the T1 Transient protection card.

Figure 14-1 ***T1 Transient protection card***

Performance specifications

Table 14-1 lists the specifications.

Table 14-1 ***T1 Transient protection card performance specifications***

Specification	Value or range
Operating temperature	32˚ to 104˚ F (0˚ to 40˚ C)
Storage temperature	-40˚ to 185˚ F (-40˚ to 85˚ C)
Humidity	5% to 95% (non-condensing)

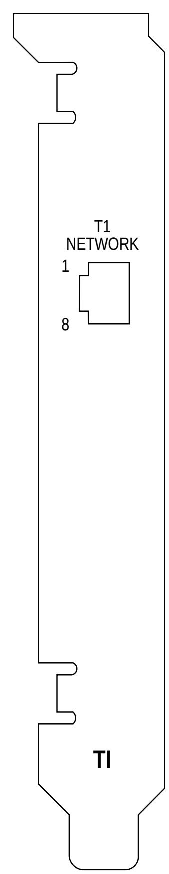
Theory of operation

The T1 Transient protection card provides the physical interface point to the network and conditions the signals.

The T1 is first routed through transient protection circuitry before being processed by the STP. The circuitry protects the STP card from surges on the T1 line. When line surges are present, a zener diode network shunts the excess voltage to ground, preventing the surge from passing through to the STP card. In addition to the zener network, positive temperature coefficient resistors open in case of a power cross.

Connector

Figure 14-2 shows the RJ48 connector labeled T1 NETWORK. This connector provides the connection to the network.



PINOUT OF T1 NETWORK CONNECTOR

Pin	Description
1+2	Receive From Network
3	No Connection
4+5	Transmit to Network
6	No Connection
7	GND
8	GND

iSC069
090696SN

Figure 14-2 ***T1 Transient protection card (rear view of Controller)***

E1 Transient protection cards

The E1 Transient protection card provides the physical interface point to the network and conditions the signals before further processing by the SEP card. A BNC connection is used for 75Ω unbalanced networks and a DB15 connection is used for 120Ω balanced networks.

The E1 Transient protection circuitry protects the SEP card from surges on the E1 line. When line surges are present, a zener diode network shunts the excess voltage to ground, preventing the surge from passing through to the SEP card. In addition to the zener network, positive temperature coefficient resistors open the line in case of a power cross.

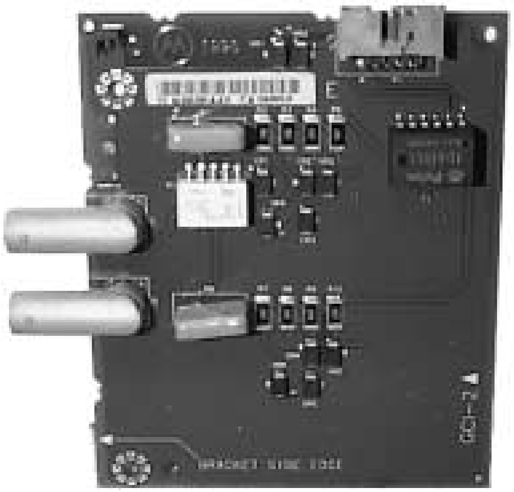
Performance specifications

Table 14-2 lists the specifications.

Table 14-2 ***E1 Transient protection card performance specifications***

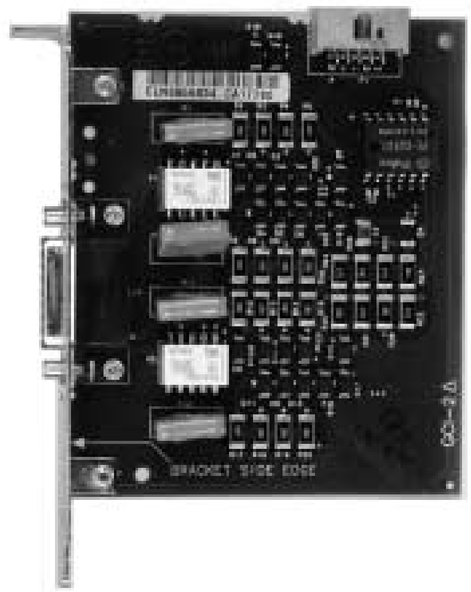
Specification	Value or range
Operating temperature	32˚ to 104˚ F (0˚ to 40˚ C)
Storage temperature	-40˚ to 185˚ F (-40˚ to 85˚ C)
Humidity	5% to 95% (non-condensing)

Figure 14-3 shows the 75Ω and 120Ω E1 Transient cards.



iSC093-H
100796JNM

75Ω E1



PINOUT OF DB15
120Ω E1 CONNECTOR

PIN	DESCRIPTION
1	DATA IN
3	DATA OUT
9	DATA IN
11	DATA OUT

iSC090-H
100696JNM

120Ω E1

Figure 14-3 ***75Ω and 120Ω E1 Transient protection cards***

Theory of operation

The E1 Transient protection cards provide the physical interface point to the network and conditions the signals.

The E1 is first routed through transient protection circuitry before being processed by the SEP. The circuitry protects the SEP card from surges on the E1 line. When line surges are present, a zener diode network shunts the excess voltage to ground, preventing the surge from passing through to the SEP card. In addition to the zener network, positive temperature coefficient resistors open in case of a power cross.

Connectors

Figure 14-4 shows the 75Ω and 120Ω E1 Transient card connectors. BNC connectors labeled RECEIVE and TRANSMIT are used for 75Ω unbalanced networks and a DB15 connector labeled NETWORK is used for 120Ω balanced networks.

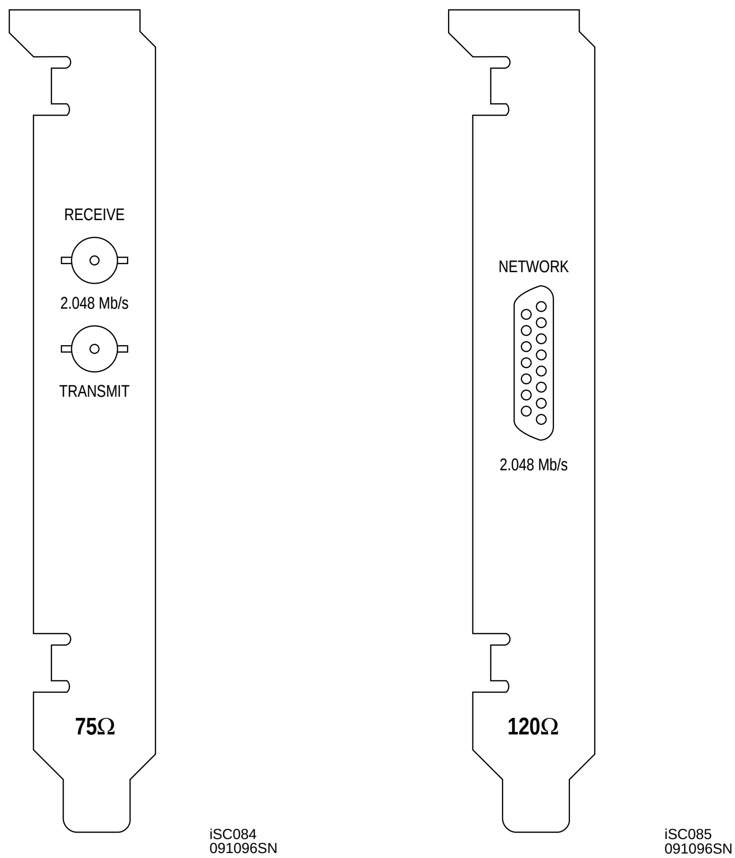


Figure 14-4 ***75Ω and 120Ω E1 Transient cards (rear view of Controller)***

Serial/Parallel Transient protection card

All external data connections are routed through transient protection circuitry before arriving at the PowerPC motherboard. The Serial/Parallel Transient protection card is the connection point for the RS232 and IEEE 1284 connections between the Controller and the iMU.

Figure 14-5 shows the Serial/Parallel Transient protection card.

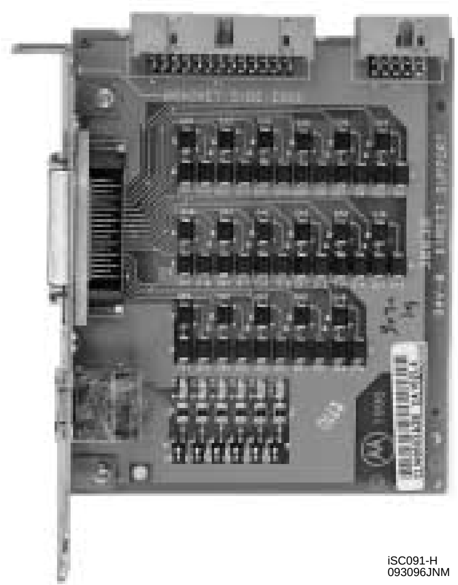


Figure 14-5 ***Serial/Parallel Transient protection card***

Performance specifications

Table 14-3 lists the specifications.

Table 14-3 ***Serial/Parallel Transient protection card performance specifications***

Specification	Value or range
Operating temperature	32˚ to 104˚ F (0˚ to 40˚ C)
Storage temperature	-40˚ to 185˚ F (-40˚ to 85˚ C)
Humidity	5% to 95% (non-condensing)

Theory of operation

The S/P Transient protection card provides physical interface points for communicating with Controller peripherals (via RJ45 for RS232 serial port, DB36 for the IEEE 1284 parallel port) and conditions the signals before being routed on to the PowerPC motherboard.

The S/P card circuitry protects the PowerPC motherboard from surges on the serial (RS232) and parallel (IEEE 1284) data lines. When line surges are present on the data lines, zener diode networks shunt the excess voltage to ground, preventing the surge form passing through to the motherboard. Capacitors are also included for additional filtering.

Connectors

Figure 14-6 shows the S/P card connectors. Two connectors labeled PARALLEL and SERIAL are provided for connection to the iMU. The 36-pin parallel connector passes alarm commands and responses. The RJ48 connector provides a serial link for control signals to the iMU.

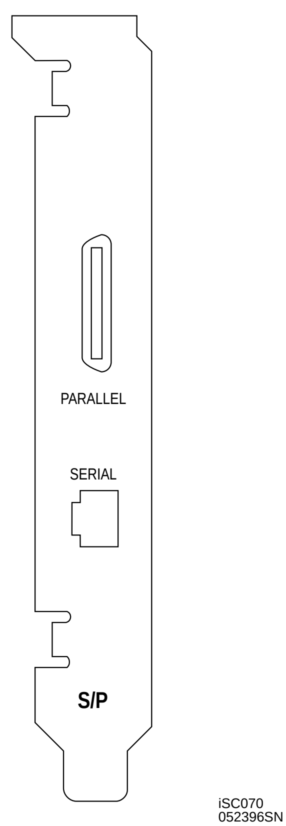


Figure 14-6 ***Serial/Parallel Transient protection card (rear view of Controller)***

15

iDEN Monitor Unit

Chapter overview

This chapter provides technical information for the iDEN Monitor Unit (iMU).

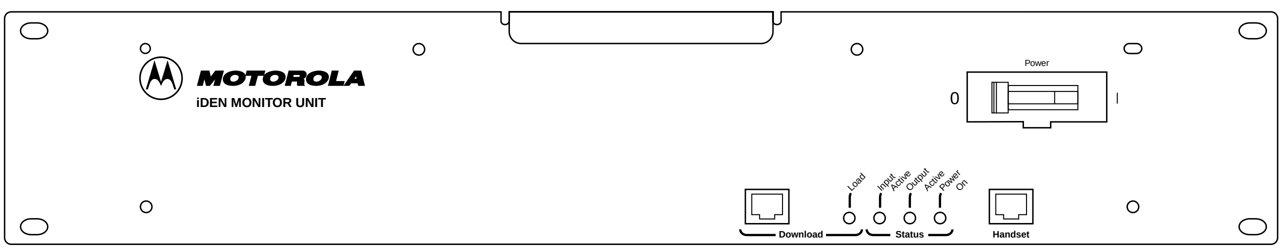
The topics of this chapter are listed in the following table.

iDEN Monitor Unit

The iDEN Monitor Unit (iMU) provides a central location for the processing of site alarm signals. The iMU monitors the environmental conditions of the site, including AC power, smoke alarms, intrusion alarms, antenna tower lights, etc.

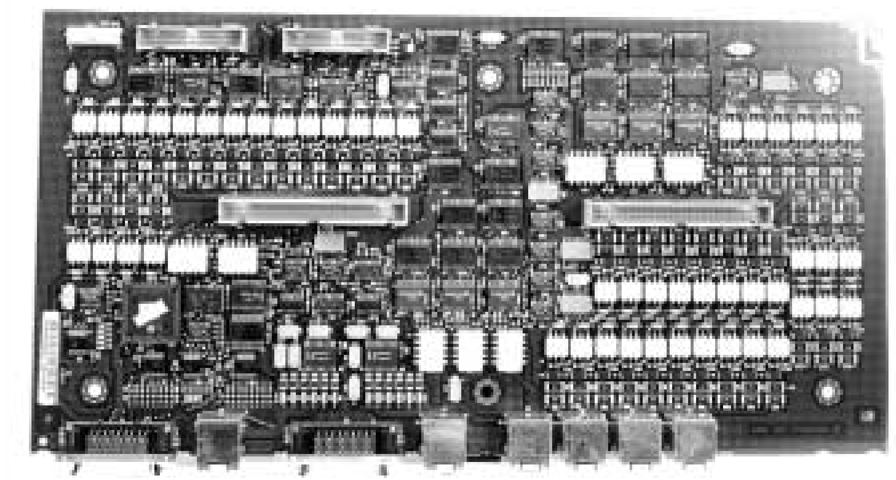
Alarm wiring is also routed from the EBTS equipment and Power Supply rack directly to the iMU. All alarms are forwarded to the integrated Site Controller (iSC) and stored in memory.

The iMU also contains the integrated Dispatch Enhanced Network (iDEN) Base Monitor Radio (BMR). The BMR is used for functional verification of fixed network equipment (FNE) within an iDEN system. Figure 15-1 shows the iMU and Figure 15-2 shows the iMU main card.



iSC042
060796JNM

Figure 15-1 ***iDEN Monitor Unit (front view)***



iSC048-H
052096JNM

Figure 15-2 ***iMU main card***

Power Supply Unit

Each iMU has its own power supply. The Power Supply Unit (PSU) accepts a 48 VDC nominal input and provides all of the necessary internal DC voltages. Figure 15-3 shows the PSU.

iSC047-H
052096JNM

Figure 15-3 ***iMU Power Supply Unit***

Indicators

Table 15-1 lists and describes the iMU indicators.

Table 15-1 ***iMU indicators***

LED	Color	Description when lit
Download		
Load	yellow	Indicates software is being loaded to the subscriber unit.
Status		
Input Active	red	Indicates an active input.
Output Active	yellow	Indicates an active output.
Power On	green	Indicates the unit is on.

Performance specifications

Table 15-2 lists the specifications.

Table 15-2 ***iMU performance specifications***

Specification	Value
Input supply voltage range	-40 to -60 Vdc
Operating temperature range	32˚ to 104˚ F (0˚ to 40˚ C)
Storage temperature range	-40˚ to 185˚ F (-40˚ to 85˚ C)
Physical dimensions:	
Height	2 Rack Units (RU)
Width	19 inches (482.6 mm)
Humidity	5% to 95% (non-condensing)
Maximum length loop	24 or 32 awg wire => 2000’ (610m)
Alarm input “ON” current	5.0 mA min.
Alarm input “OFF” current	0.1 mA max.

Table 15-2 ***iMU performance specifications — continued***

Specification	Value
Transmitter specifications (800 MHz): Transmit frequency range Maximum RF output power	806-821 MHz -70 dBm *
Receiver specifications (800 MHz): Receive frequency range	851-866 MHz
Transmitter specifications (900 MHz): Transmit frequency range Maximum RF output power	896-901 MHz -70 dBm *
Receiver specifications (900 MHz): Receive frequency range	935-940 MHz
* Requires external attenuation	

Theory of operation

The iMU provides a direct interface between the iSC and various site alarms. The iMU also provides the necessary I/O interfacing between the subscriber unit, the Controller, and a mobile handset and verifies the functionality of the FNE within the site. Figure 15-4 shows a functional block diagram of the iMU.

The iMU is configured for 48 dry contact input sensors and 8 relay closure outputs. Each I/O module provides 4000V of isolation between field wiring and sensitive control circuitry.

The iMU and site Controller interact in a master/slave relationship. The site Controller sends commands to the iMU to determine the status of alarm inputs or set the state of control outputs.

The iMU continuously scans the status of the alarm inputs, ensuring that all alarms are consistently monitored.

A mobile subscriber unit is mounted within the iMU housing for the BMR function. The subscriber unit is a microprocessor-controlled, full duplex, standard production mobile unit containing specialized software for use within the system.

iDEN Monitor Unit

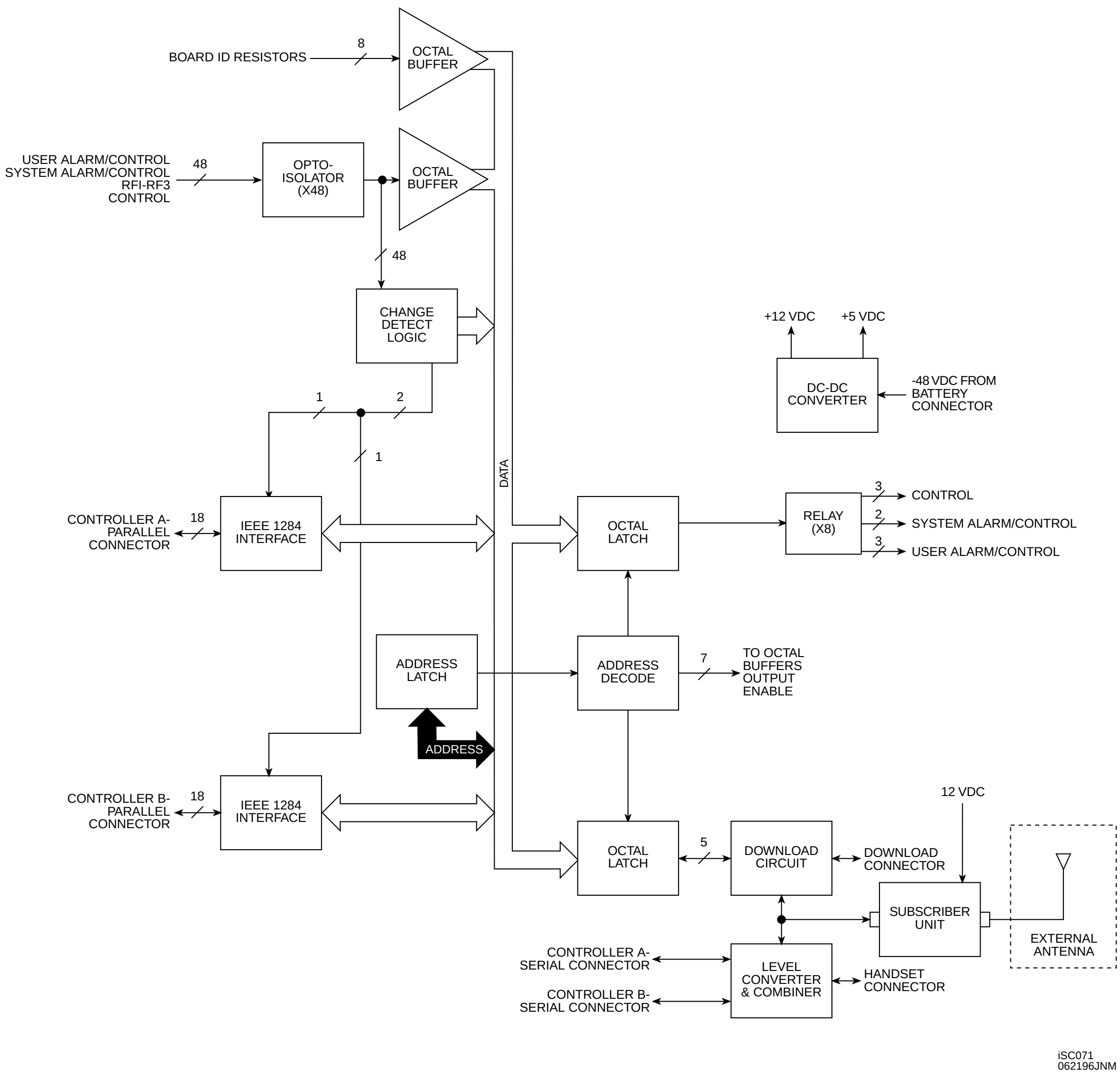


Figure 15-4 ***iMU block diagram***

Connectors

Figure 15-4 shows the rear view of the iMU. Table 15-3 lists and describes the iMU connectors.

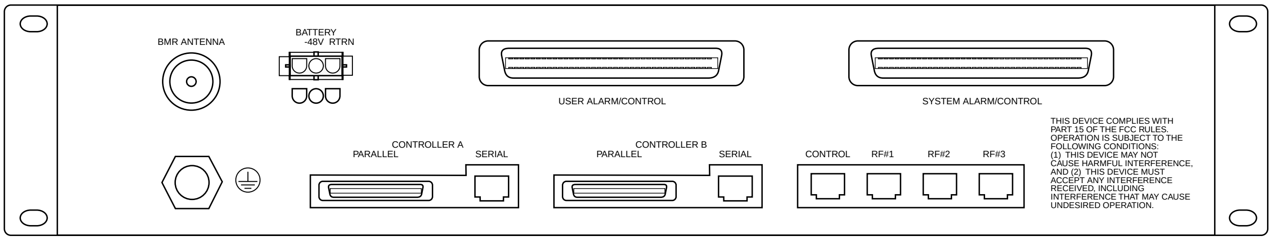


Figure 15-5 ***iMU (rear view)***

Table 15-3 ***iMU connectors***

Connector	Type	Description
	Front panel	
Download	RJ48	Allows a PC parallel port to connect to the iMU for downloading software. ***NOTE:*** Software updates are made without removing the subscriber unit from the cabinet.
Handset	RJ48	Provides a connection to access the BMR for all SB9600 compatible iDEN peripheral devices, such as a iDEN handset. Also provides a connection for code plug programming.
	Rear panel	
BMR Antenna	N-type	Provides a connection for a BMR antenna. **CAUTION:** Install an RF attenuator in series before an antenna cable is connected. Refer to the BMR antenna system design paragraph for determining the attenuator value.
Battery– -48V RTRN	3-pin	Provides a connection for -48Vdc input power and ground from the site power supply.
GND	Ground stud	Provides a connection for the chassis ground.

Table 15-3 ***iMU connectors — continued***

Connector	Type	Description
User Alarm/ Control	Champ	Provides a connection for the site alarms through a Champ cable. Refer to the Preinstallation chapter for pinout details. ***NOTE:*** All customer provisioned connections are inputs, except for pins 1, 2, 26 and 3, 4, 28 which are outputs.
System Alarm/ Control	Champ	Provides a connection for the site alarms through a Champ cable. Refer to the Preinstallation chapter for pinout details. ***NOTE:*** 1, 2, 26; 3, 4, 28; & 5, 6, 30 are outputs.
Controller A - Parallel	36-pin IEEE 1284	Provides a parallel link for alarm commands and responses to Controller A. The alarm commands and responses are passed via an IEEE 1284 cable.
Controller A - Serial	RJ48	Provides a serial link for control signals between the iMU and Controller A.
Controller B - Parallel	36-pin IEEE 1284	Provides a parallel link for alarm commands and responses to Controller B. The alarm commands and responses are passed via an IEEE 1284 cable.
Controller B - Serial	RJ48	Provides a serial link for control signals between the iMU and Controller B.
Control	RJ48	Provides an alarm connection to the Cabinet Circuit Breaker Panel. The alarm is activated when any breaker is tripped or set to the OFF position. ***NOTE:*** If a cavity combining system is used in the RF Cabinet, a pair of color-coded wires for Primary Control Channel (PCCH) redundancy for each sector are branched from this modular cable and are terminated with a Mate-n-Lock connector. The color coding corresponds to a predetermined sector within the system. This connector is routed to the appropriate RF Cabinet and connected to a mating connector. This signal controls the antenna switches used for PCCH redundancy.

Table 15-3 ***iMU connectors — continued***

Connector	Type	Description
RF#1	modular	Provides an alarm connection for RF Cabinet #1: **for duplexed systems** – provides a connection to the ALARM connector on the RF Cabinet Junction Panel **for cavity combining systems** – provides a connection to the ALARM connector on the Power Supply tray of the RFDS The RF equipment that is monitored includes: • RF Cabinet Breaker Panel – activates when any breaker is tripped or set to OFF. • RFDS Power Supplies – activates when either power supply FRU fails. • RFDS low noise RF amplifiers – activates when any failure occurs with either RF amplifier. • tower top antenna RF amplifiers (cavity combining systems only) – activates when any failure occurs with the tower top antenna RF amplifiers.
RF#2	modular	Same as RF#1 except provides a connection to RF Cabinet #2.
RF#3	modular	Same as RF#1 except provides a connection to RF Cabinet #3.

Serial interface

There are two available connectors on the rear of the iMU for serial interface. These two connectors allow the BMR to communicate with either Controller A or Controller B.

Download interface

The Download interface allows the connection of a PC parallel port. This allows the ability to download software to the BMR.

Special software and hardware are required to program the BMR. For the appropriate software, refer to the latest software release notes. For the hardware, a specially wired DB-25 to 8-pin modular cable is required.

When the cable is inserted into the Download port, downloading begins and the load LED turns on to indicate that the BMR is not in a normal operational state. Once downloading is complete and the cable is removed from the port, the LED turns off.

BMR antenna system design

The following procedure is for designing a BMR antenna system. This procedure is intended for a BMR to access a co-located cell site only.

1. Calculate the maximum uplink path attenuator value. This value allows the BMR to communicate with the co-located site.

   Table 15-4 shows an example with some typical values.

Table 15-4 ***Maximum attenuator calculation for uplink path***

Description	Value
BMR transmitter output power	**20 dBm**
BMR to antenna line loss	-3 dB
maximum expected local isolation	-40 dB
antenna to cell site line loss	-3 dB
maximum allowable signal at cell site	-75 dBm
maximum uplink attenuator value: (maximum attenuation allowed for an adequate RF signal from BMR to co-located cell site)	**49 dB**

2. Calculate the maximum downlink path attenuator value. This value allows the co-located site to communicate with the BMR.

   Table 15-5 shows an example with some typical values.

Table 15-5 ***Maximum attenuator calculation for downlink path***

Description	Value (800 MHz)	Value (900 MHz)
BR transmitter output power	**44 dBm**	**43 dBm**
maximum expected local isolation	- 40 dB	-40 dB
antenna to cell site line loss	- 3 dB	-3 dB
BMR to antenna line loss	- 3 dB	-3 dB
minimum required signal at BMR	- 75 dBm	-75 dBm
maximum downlink attenuator value: (maximum attenuation allowed for an adequate RF signal from co-located cell site to BMR)	**73 dB**	**72 dB**

3. The smaller of the two attenuator values from steps 1 and 2 represents an acceptable attenuation for the above assumptions.

   The 49 dB attenuator obtained in step 1 is acceptable because it does not violate the restrictions for overload and intermodulation.

   If interference still occurs when the maximum allowed attenuator is used between the BMR and its antenna, physically move the BMR antenna lower until the problem stops.

BMR RSS programming cable

Figure 15-6 provides information to locally fabricate the BMR RSS programming cable.

iDEN Monitor Unit

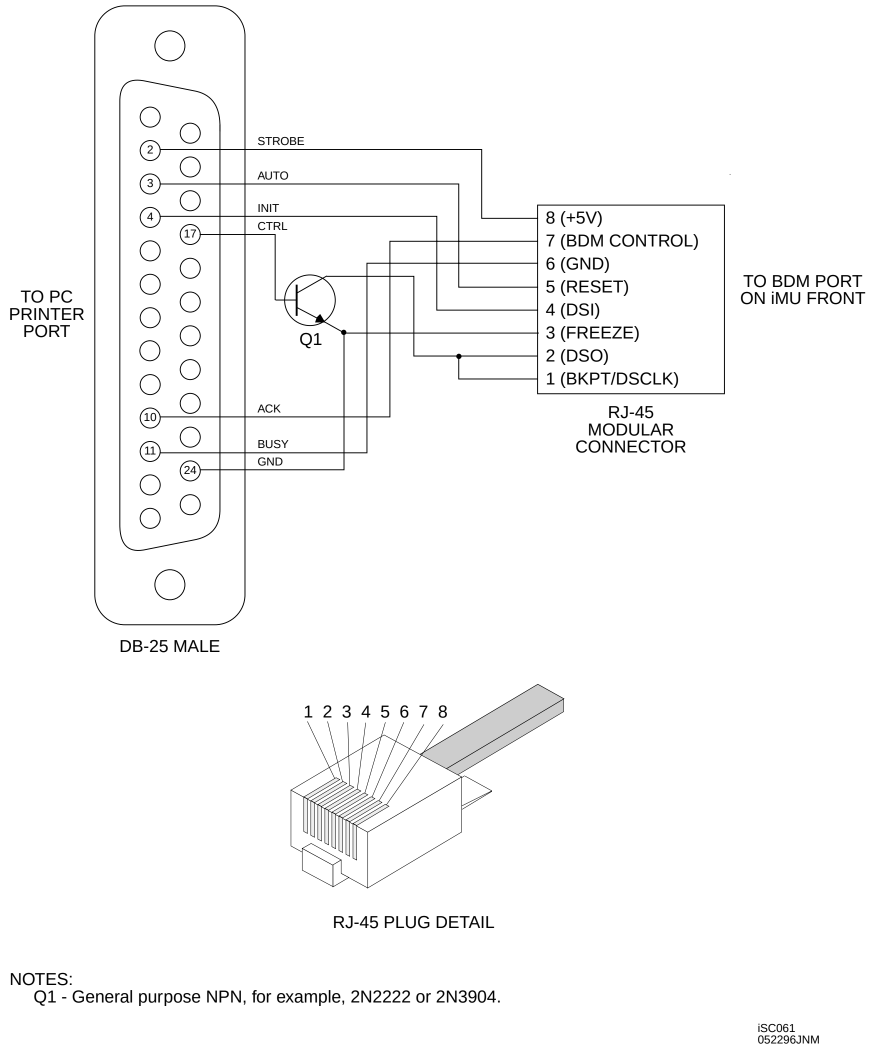


Figure 15-6 ***BMR RSS programming cable***

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FRU Replacement Procedures

Chapter overview

Table 16-1 lists the available FRUs for the iSC.

Table 16-1 ***Available FRUs***

Description	Kit number
Ethernet Lan PCI card	CLN1244A
Sub-rated T1 PCI card	CLN1246A
Sub-rated E1 PCI card	CLN1251A
Site Reference ISA card	CLN1243A
RS232 Transient card	CLN1242A
T1 Transient card	CLN1245A
E1 75Ω Transient card	CLN1250A
E1 120Ω Transient card	CLN1284A
Front Panel Display Board	CLN1305A
iMU Main Card	CLN1252A
iMU Power Supply	CPN1029A

iMU Power Supply Board Removal/Installation

Removal

Note: Keep track of iMU cabling connections when removing and reconnecting cables. Label each cable that connects to the iMU before removing cable.

Note: The site will be shut down during the following procedures.

1. Remove power from the iMU by setting the following circuit breakers on the Circuit Breaker Panel to OFF.
   - CTRL A
   - EAS/IMU
   - CTRL B
2. Disconnect the cables from the back of the iMU in the order listed:

Connector
BATTERY
BMR ANTENNA
USER ALARM/CONTROL
SYSTEM ALARM/CONTROL
CONTROLLER A PARALLEL
CONTROLLER A SERIAL
CONTROLLER B PARALLEL
CONTROLLER B SERIAL

Connector — continued
CONTROL
RF#1
RF#2
RF#3
GND

3. Remove the four mounting screws from the front panel of the iMU.
4. Using the handle on the front of the iMU, remove the iMU from the Cabinet.
5. Remove the cover from the iMU.

   Note: The Power Supply Board (kit # CLN6814A) is mounted at the front of the iMU and held in place by four screws.

6. Label and remove the following internal cables from the Power Supply Board in the order listed:

Cable	Part Number	CLN6814A Connector
-48 V Power	3082114X02	P1
Mobile Unit Power	3082402V01	P2
iMU Main Board Power	3085431U05	P3
iMU Main Board Signal	3085427U01	J1

7. Remove the four screws securing the Power Supply Board to the iMU chassis.
8. Remove the Power Supply Board from the iMU chassis.
9. Record the bar code number of the faulty Power Supply Board in the site records.

Installation

1. Unpack the new Power Supply Board and record the bar code number in the site records.
2. Place the Power Supply Board into mounting position in the iMU chassis.
3. Using the four Power Supply Board mounting screws removed during removal procedure, secure the Power Supply Board to the iMU chassis.
4. Connect the following internal cables to the Power Supply Board in the order listed:

Cable	Part Number	CLN6814 Connector
iMU Main Board Signal	3085427U01	J1
iMU Main Board Power	3085431U05	P3
Mobile Unit Power	3082402V01	P2
-48 V Power	3082114X02	P1

5. Snap the cover back on the iMU chassis.
6. Place the iMU in the Cabinet.
7. Using the four iMU mounting screws removed during removal procedure, secure the iMU to the front of the Cabinet.

   Using a torque wrench, torque the screws to 40 in-lbs.
8. Connect the following cables to the back of the iMU in the order listed:

Connector
GND
RF#3
RF#2
RF#1
CONTROL

Connector — continued
CONTROLLER B SERIAL
CONTROLLER B PARALLEL
CONTROLLER A SERIAL
CONTROLLER A PARALLEL
SYSTEM ALARM/CONTROL
USER ALARM/CONTROL
BMR ANTENNA
BATTERY

9. Turn on iMU by setting the following circuit breakers on the Circuit Breaker Panel to ON.
   - CTRL A
   - EAS/IMU
   - CTRL B

iMU Main Board Removal/ Installation

Removal

Note: Keep track of iMU cabling connections when removing and reconnecting cables. Label each cable that connects to the iMU before removing cable.

Note: The site will be shut down during the following procedures.

1. Remove power from the iMU by setting the following circuit breakers on the Circuit Breaker Panel to OFF.
   - CTRL A
   - EAS/IMU
   - CTRL B
2. Disconnect the cables from the back of the iMU in the order listed:

Connector
BATTERY
BMR ANTENNA
USER ALARM/CONTROL
SYSTEM ALARM/CONTROL
CONTROLLER A PARALLEL
CONTROLLER A SERIAL
CONTROLLER B PARALLEL
CONTROLLER B SERIAL

Connector — continued
CONTROL
RF#1
RF#2
RF#3
GND

3. Remove the four mounting screws from the front panel of the iMU.
4. Using the handle on the front of the iMU, remove the iMU from the Cabinet.
5. Remove the cover from the iMU.

   Note: The Main Board (kit # CLN6729A) is mounted at the rear of the iMU and held in place by six screws.

6. Label and remove the following internal cables from the Main Board in the order listed:

Cable	Part Number	CLN6729A Connector
iMU Main Board Power	3085431U05	P11
iMU Main Board Signal	3085427U01	P12
Mobile Signal	3082401V02	P13
System Alarm/Control	3083416X01	P10
User Alarm/Control	3083416X01	P9

7. Remove the six screws securing the Main Board to the iMU chassis.
8. Remove the Main Board from the iMU chassis.
9. Record the bar code number of the faulty Power Supply Board in the site records.

Installation

1. Unpack the new Main Board and record the bar code number in the site records.
2. Place the Main Board into mounting position in the iMU chassis.
3. Using the six Main Board mounting screws removed during removal procedure, secure the Main Board to the iMU chassis.
4. Connect the following internal cables to the Main Board in the order listed:

Cable	Part Number	CLN6729 Connector
User Alarm/Control	3083416X01	P9
System Alarm/Control	3083416X01	P10
Mobile Signal	3082401V02	P13
iMU Main Board Signal	3085427U01	P12
iMU Main Board Power	3085431U05	P11

5. Snap the cover back on the iMU chassis.
6. Place the iMU in the Cabinet.
7. Using the four iMU screws removed during removal procedure, secure the iMU to the front of the Cabinet.

   Using a torque wrench, torque the screws to 40 in-lbs.
8. Connect the following cables to the back of the iMU in the order listed:

Connector
GND
RF#3
RF#2
RF#1
CONTROL

Connector — continued
CONTROLLER B SERIAL
CONTROLLER B PARALLEL
CONTROLLER A SERIAL
CONTROLLER A PARALLEL
SYSTEM ALARM/CONTROL
USER ALARM/CONTROL
BMR ANTENNA
BATTERY

9. Turn on iMU by setting the following circuit breakers on the Circuit Breaker Panel to ON.
   - CTRL A
   - EAS/IMU
   - CTRL B

iSC S/P Transient Card Removal/Installation

Removal

Note: Keep track of Controller cabling connections when removing and reconnecting cables. Label each cable that connects to the Controller before removing cable.

1. Remove power from the Controller being removed by setting the respective circuit breaker (CTRL A or CTRL B) on the Circuit Breaker Panel to OFF.

2. Disconnect the cables from the back of the Controller in the order listed:

T1 Controller		E1 120Ω Controller		E1 75Ω Controller	
Connector	**Located on:**	**Connector**	**Located on:**	**Connector**	**Located on:**
BATTERY		BATTERY		BATTERY	
T1 NETWORK	T1 Card	NETWORK	E1 120Ω Card	RECEIVE	E1 75Ω Card
PARALLEL	S/P Card	PARALLEL	S/P Card	TRANSMIT	E1 75Ω Card
SERIAL	S/P Card	SERIAL	S/P Card	PARALLEL	S/P Card
OUT 1	SRI Card	OUT 1	SRI Card	SERIAL	S/P Card
OUT 2 (if used)	SRI Card	OUT 2 (if used)	SRI Card	OUT 1	SRI Card
REDUND	SRI Card	REDUND	SRI Card	OUT 2 (if used)	SRI Card
GPS ANT	SRI Card	GPS ANT	SRI Card	REDUND	SRI Card
REDUND	STP Card	REDUND	SEP Card	GPS ANT	SRI Card
10 Mbs	ELP Card	10 Mbs	ELP Card	REDUND	SEP Card
GND		GND		10 Mbs	ELP Card
				GND	

3. Remove the four mounting screws from the front panel of the Controller.

4. Using the handle on the front of the Controller, remove the Controller from the Cabinet.

5. Remove the cover from the Controller.

Note: The S/P Transient Card is located in slot 9 of the Controller and is held in place by one screw.

6. Disconnect the following cables from the S/P Transient Card in the order listed:

Cable	Part Number	S/P Transient Card connector
26 pin ribbon	3085427U03	P1
10 pin ribbon	3082057V05	P2

7. Remove the screw securing the S/P Transient Card to the Controller chassis.

8. Remove the S/P Transient Card from the Controller chassis.

9. Record the bar code number of the faulty S/P Transient Card in the site records.

Installation

1. Unpack the new S/P Transient Card and record the bar code number in the site records.

2. Place the S/P Transient Card into mounting position in the Controller chassis.

3. Using the S/P Transient Card mounting screw removed during removal procedure, secure the S/P Transient Card to the Controller chassis.

iSC S/P Transient Card Removal/Installation

4. Connect the following S/P Transient Card cables in the order listed:

Cable	Part Number	S/P Transient Card connector
10 pin ribbon	3082057V05	P2
26 pin ribbon	3085427U03	P1

5. Snap the cover back on the Controller chassis.

6. Place the Controller in the Cabinet.

7. Using the four Controller mounting screws removed during removal procedure, secure the Controller to the front of the Cabinet.

   Using a torque wrench, torque the screws to 40 in-lbs.

8. Connect the following cables to the back of the Controller in the order listed:

T1 Controller		E1 120Ω Controller		E1 75Ω Controller	
Connector	**Located on:**	**Connector**	**Located on:**	**Connector**	**Located on:**
GND		GND		GND	
10 Mbs	ELP Card	10 Mbs	ELP Card	10 Mbs	ELP Card
REDUND	STP Card	REDUND	SEP Card	REDUND	SEP Card
GPS ANT	SRI Card	GPS ANT	SRI Card	GPS ANT	SRI Card
REDUND	SRI Card	REDUND	SRI Card	REDUND	SRI Card
OUT 1	SRI Card	OUT 1	SRI Card	OUT 1	SRI Card
OUT 2 (if used)	SRi Card	OUT 2 (if used)	SRi Card	OUT 2 (if used)	SRi Card
SERIAL	S/P Card	SERIAL	S/P Card	SERIAL	S/P Card
PARALLEL	S/P Card	PARALLEL	S/P Card	PARALLEL	S/P Card
T1 NETWORK	T1 Card	NETWORK	E1 120Ω Card	TRANSMIT	E1 75Ω Card
BATTERY		BATTERY		RECEIVE	E1 75Ω Card
				BATTERY	

9. Turn on Controller by setting the respective circuit breakers (CTRL A or CTRL B) on the Circuit Breaker Panel to ON.

iSC SRI Card Removal/ Installation

Removal

Note: Keep track of Controller cabling connections when removing and reconnecting cables. Label each cable that connects to the Controller before removing cable.

1. Remove power from the Controller being removed by setting the respective circuit breaker (CTRL A or CTRL B) on the Circuit Breaker Panel to OFF.
2. Disconnect the cables from the back of the Controller in the order listed:

T1 Controller		E1 120Ω Controller		E1 75Ω Controller	
Connector	**Located on:**	**Connector**	**Located on:**	**Connector**	**Located on:**
BATTERY		BATTERY		BATTERY	
T1 NETWORK	T1 Card	NETWORK	E1 120Ω Card	RECEIVE	E1 75Ω Card
PARALLEL	S/P Card	PARALLEL	S/P Card	TRANSMIT	E1 75Ω Card
SERIAL	S/P Card	SERIAL	S/P Card	PARALLEL	S/P Card
OUT 1	SRI Card	OUT 1	SRI Card	SERIAL	S/P Card
OUT 2 (if used)	SRI Card	OUT 2 (if used)	SRI Card	OUT 1	SRI Card
REDUND	SRI Card	REDUND	SRI Card	OUT 2 (if used)	SRI Card
GPS ANT	SRI Card	GPS ANT	SRI Card	REDUND	SRI Card
REDUND	STP Card	REDUND	SEP Card	GPS ANT	SRI Card
10 Mbs	ELP Card	10 Mbs	ELP Card	REDUND	SEP Card
GND		GND		10 Mbs	ELP Card
				GND	

3. Remove the four mounting screws from the front panel of the Controller.

4. Using the handle on the front of the Controller, remove the Controller from the Cabinet.

5. Remove the cover from the Controller.

Note: The SRI Card is located in slot 7 of the Controller and is held in place by two screws.

6. Disconnect the following cable from the SRI Card:

Cable	Part Number	SRI Card connector
20 pin ribbon	303414X01	P1

7. Remove the screws securing the SRI Card to the Controller chassis.

8. Remove the SRI Card from the Controller chassis.

9. Record the bar code number of the faulty SRI Card in the site records.

Installation

1. Unpack the new SRI Card and record the bar code number in the site records.

2. Place the SRI Card into mounting position in the Controller chassis.

3. Using the SRI Card mounting screws removed during removal procedure, secure the SRI Card to the Controller chassis.

4. Connect the following SRI Card cable:

Cable	Part Number	SRI Card connector
20 pin ribbon	303414X01	P1

5. Snap the cover back on the Controller chassis.

6. Place the Controller in the Cabinet.

7. Using the four Controller mounting screws removed during removal procedure, secure the Controller to the front of the Cabinet.

Using a torque wrench, torque the screws to 40 in-lbs.

8. Connect the following cables to the back of the Controller in the order listed:

T1 Controller		E1 120Ω Controller		E1 75Ω Controller	
Connector	**Located on:**	**Connector**	**Located on:**	**Connector**	**Located on:**
GND		GND		GND	
10 Mbs	ELP Card	10 Mbs	ELP Card	10 Mbs	ELP Card
REDUND	STP Card	REDUND	SEP Card	REDUND	SEP Card
GPS ANT	SRI Card	GPS ANT	SRI Card	GPS ANT	SRI Card
REDUND	SRI Card	REDUND	SRI Card	REDUND	SRI Card
OUT 1	SRI Card	OUT 1	SRI Card	OUT 1	SRI Card
OUT 2 (if used)	SRI Card	OUT 2 (if used)	SRI Card	OUT 2 (if used)	SRI Card
SERIAL	S/P Card	SERIAL	S/P Card	SERIAL	S/P Card
PARALLEL	S/P Card	PARALLEL	S/P Card	PARALLEL	S/P Card
T1 NETWORK	T1 Card	NETWORK	E1 120Ω Card	TRANSMIT	E1 75Ω Card
BATTERY		BATTERY		RECEIVE	E1 75Ω Card
				BATTERY	

9. Turn on Controller by setting the respective circuit breakers (CTRL A or CTRL B) on the Circuit Breaker Panel to ON.

iSC ELP Card Removal/ Installation

Removal

Note: Keep track of Controller cabling connections when removing and reconnecting cables. Label each cable that connects to the Controller before removing cable.

1. Remove power from the Controller being removed by setting the respective circuit breaker (CTRL A or CTRL B) on the Circuit Breaker Panel to OFF.

2. Disconnect the cables from the back of the Controller in the order listed:

T1 Controller		E1 120Ω Controller		E1 75Ω Controller	
Connector	**Located on:**	**Connector**	**Located on:**	**Connector**	**Located on:**
BATTERY		BATTERY		BATTERY	
T1 NETWORK	T1 Card	NETWORK	E1 120Ω Card	RECEIVE	E1 75Ω Card
PARALLEL	S/P Card	PARALLEL	S/P Card	TRANSMIT	E1 75Ω Card
SERIAL	S/P Card	SERIAL	S/P Card	PARALLEL	S/P Card
OUT 1	SRI Card	OUT 1	SRI Card	SERIAL	S/P Card
OUT 2 (if used)	SRI Card	OUT 2 (if used)	SRI Card	OUT 1	SRI Card
REDUND	SRI Card	REDUND	SRI Card	OUT 2 (if used)	SRI Card
GPS ANT	SRI Card	GPS ANT	SRI Card	REDUND	SRI Card
REDUND	STP Card	REDUND	SEP Card	GPS ANT	SRI Card
10 Mbs	ELP Card	10 Mbs	ELP Card	REDUND	SEP Card
GND		GND		10 Mbs	ELP Card
				GND	

3. Remove the four mounting screws from the front panel of the Controller.

4. Using the handle on the front of the Controller, remove the Controller from the Cabinet.

5. Remove the cover from the Controller.

   Note: The ELP Card is located in slot 1 of the Controller and is held in place by one screw.

6. Remove the screw securing the ELP Card to the Controller chassis.

7. Remove the ELP Card from the Controller chassis.

8. Record the bar code number of the faulty ELP Card in the site records.

Installation

1. Unpack the new ELP Card and record the bar code number in the site records.

2. Place the ELP Card into mounting position in the Controller chassis.

3. Using the ELP Card mounting screw removed during removal procedure, secure the ELP Card to the Controller chassis.

4. Snap the cover back on the Controller chassis.

5. Place the Controller in the Cabinet.

6. Using the four Controller mounting screws removed during removal procedure, secure the Controller to the front of the Cabinet.

   Using a torque wrench, torque the screws to 40 in-lbs.

7. Connect the following cables to the back of the Controller in the order listed:

T1 Controller		E1 120Ω Controller		E1 75Ω Controller	
Connector	**Located on:**	**Connector**	**Located on:**	**Connector**	**Located on:**
GND		GND		GND	
10 Mbs	ELP Card	10 Mbs	ELP Card	10 Mbs	ELP Card
REDUND	STP Card	REDUND	SEP Card	REDUND	SEP Card
GPS ANT	SRI Card	GPS ANT	SRI Card	GPS ANT	SRI Card
REDUND	SRI Card	REDUND	SRI Card	REDUND	SRI Card
OUT 1	SRI Card	OUT 1	SRI Card	OUT 1	SRI Card
OUT 2 (if used)	SRI Card	OUT 2 (if used)	SRI Card	OUT 2 (if used)	SRI Card
SERIAL	S/P Card	SERIAL	S/P Card	SERIAL	S/P Card
PARALLEL	S/P Card	PARALLEL	S/P Card	PARALLEL	S/P Card
T1 NETWORK	T1 Card	NETWORK	E1 120Ω Card	TRANSMIT	E1 75Ω Card
BATTERY		BATTERY		RECEIVE	E1 75Ω Card
				BATTERY	

8. Turn on Controller by setting the respective circuit breakers (CTRL A or CTRL B) on the Circuit Breaker Panel to ON.

iSC T1 Transient Card Removal/Installation

Removal

Note: Keep track of Controller cabling connections when removing and reconnecting cables. Label each cable that connects to the Controller before removing cable.

1. Remove power from the Controller being removed by setting the respective circuit breaker (CTRL A or CTRL B) on the Circuit Breaker Panel to OFF.

2. Disconnect the cables from the back of the Controller in the order listed:

Connector	Located on:
BATTERY	
T1 NETWORK	T1 Card
PARALLEL	S/P Card
SERIAL	S/P Card
OUT 1	SRI Card
OUT 2 (if used)	SRI Card
REDUND	SRI Card
GPS ANT	SRI Card
REDUND	STP Card
10 Mbs	ELP Card
GND	

3. Remove the four mounting screws from the front panel of the Controller.

4. Using the handle on the front of the Controller, remove the Controller from the Cabinet.

5. Remove the cover from the Controller.

Note: The T1 Transient Card is located in slot 10 of the Controller and is held in place by one screw.

6. Disconnect the following cable from the T1 Transient Card:

Cable	Part Number	T1 Transient Card connector
10 pin ribbon	3082057V06	P1

7. Remove the screw securing the T1 Transient Card to the Controller chassis.

8. Remove the T1 Transient Card from the Controller chassis.

9. Record the bar code number of the faulty T1 Transient Card in the site records.

Installation

1. Unpack the new T1 Transient Card and record the bar code number in the site records.

2. Place the T1 Transient Card into mounting position in the Controller chassis.

3. Using the T1 Transient Card mounting screw removed during removal procedure, secure the T1 Transient Card to the Controller chassis.

4. Connect the following T1 Transient Card cable:

Cable	Part Number	T1 Transient Card connector
10 pin ribbon	3082057V06	P1

5. Snap the cover back on the Controller chassis.

6. Place the Controller in the Cabinet.

7. Using the four Controller mounting screws removed during removal procedure, secure the Controller to the front of the Cabinet.

Using a torque wrench, torque the screws to 40 in-lbs.

8. Connect the following cables to the back of the Controller in the order listed:

T1 Controller	
Connector	**Located on:**
GND	
10 Mbs	ELP Card
REDUND	STP Card
GPS ANT	SRI Card
REDUND	SRI Card
OUT 1	SRI Card
OUT 2 (if used)	SRI Card
SERIAL	S/P Card
PARALLEL	S/P Card
T1 NETWORK	T1 Card
BATTERY	

9. Turn on Controller by setting the respective circuit breakers (CTRL A or CTRL B) on the Circuit Breaker Panel to ON.

iSC STP Card Removal/ Installation

Removal

Note: Keep track of Controller cabling connections when removing and reconnecting cables. Label each cable that connects to the Controller before removing cable.

1. Remove power from the Controller being removed by setting the respective circuit breaker (CTRL A or CTRL B) on the Circuit Breaker Panel to OFF.

2. Disconnect the cables from the back of the Controller in the order listed:

Connector	Located on:
BATTERY	
T1 NETWORK	T1 Card
PARALLEL	S/P Card
SERIAL	S/P Card
OUT 1	SRI Card
OUT 2 (if used)	SRI Card
REDUND	SRI Card
GPS ANT	SRI Card
REDUND	STP Card
10 Mbs	ELP Card
GND	

3. Remove the four mounting screws from the front panel of the Controller.

4. Using the handle on the front of the Controller, remove the Controller from the Cabinet.

5. Remove the cover from the Controller.

Note: The STP Card is located in slot 2 of the Controller and is held in place by two screws.

6. Disconnect the following cable from the STP Card:

Cable	Part Number	STP Card connector
26 pin ribbon	3085427U04	P1

7. Remove the screws securing the STP Card to the Controller chassis.

8. Remove the STP Card from the Controller chassis.

9. Record the bar code number of the faulty STP Card in the site records.

Installation

1. Unpack the new STP Card and record the bar code number in the site records.

2. Place the STP Card into mounting position in the Controller chassis.

3. Using the STP Card mounting screws removed during removal procedure, secure the STP Card to the Controller chassis.

4. Connect the following STP Card cable:

Cable	Part Number	STP Card connector
26 pin ribbon	3085427U04	P1

5. Snap the cover back on the Controller chassis.

6. Place the Controller in the Cabinet.

7. Using the four Controller mounting screws removed during removal procedure, secure the Controller to the front of the Cabinet.

   Using a torque wrench, torque the screws to 40 in-lbs.

8. Connect the following cables to the back of the Controller in the order listed:

T1 Controller	
Connector	**Located on:**
GND	
10 Mbs	ELP Card
REDUND	STP Card
GPS ANT	SRI Card
REDUND	SRI Card
OUT 1	SRI Card
OUT 2 (if used)	SRI Card
SERIAL	S/P Card
PARALLEL	S/P Card
T1 NETWORK	T1 Card
BATTERY	

9. Turn on Controller by setting the respective circuit breakers (CTRL A or CTRL B) on the Circuit Breaker Panel to ON.

iSC SEP Card Removal/ Installation

Removal

Note: Keep track of Controller cabling connections when removing and reconnecting cables. Label each cable that connects to the Controller before removing cable.

1. Remove power from the Controller being removed by setting the respective circuit breaker (CTRL A or CTRL B) on the Circuit Breaker Panel to OFF.

2. Disconnect the cables from the back of the Controller in the order listed:

E1 120Ω Controller		E1 75Ω Controller	
Connector	**Located on:**	**Connector**	**Located on:**
BATTERY		BATTERY	
NETWORK	E1 120Ω Card	RECEIVE	E1 75Ω Card
PARALLEL	S/P Card	TRANSMIT	E1 75Ω Card
SERIAL	S/P Card	PARALLEL	S/P Card
OUT 1	SRI Card	SERIAL	S/P Card
OUT 2 (if used)	SRI Card	OUT 1	SRI Card
REDUND	SRI Card	OUT 2 (if used)	SRI Card
GPS ANT	SRI Card	REDUND	SRI Card
REDUND	SEP Card	GPS ANT	SRI Card
10 Mbs	ELP Card	REDUND	SEP Card
GND		10 Mbs	ELP Card
		GND	

3. Remove the four mounting screws from the front panel of the Controller.

4. Using the handle on the front of the Controller, remove the Controller from the Cabinet.

5. Remove the cover from the Controller.

Note: The SEP Card is located in slot 2 of the Controller and is held in place by two screws.

6. Remove the screws securing the SEP Card to the Controller chassis.

7. Remove the following SEP Card cable:

Cable	Part Number	SEP Card connector
26 pin ribbon	3085427U04	P1

8. Remove the SEP Card from the Controller chassis.

9. Record the bar code number of the faulty SEP Card in the site records.

Installation

1. Unpack the new SEP Card and record the bar code number in the site records.

2. Place the SEP Card into mounting position in the Controller chassis.

3. Using the SEP Card mounting screws removed during removal procedure, secure the SEP Card to the Controller chassis.

4. Connect the following SEP Card cable:

Cable	Part Number	SEP Card connector
26 pin ribbon	3085427U04	P1

5. Snap the cover back on the Controller chassis.

6. Place the Controller in the Cabinet.

7. Using the four Controller mounting screws removed during removal procedure, secure the Controller to the front of the Cabinet.

Using a torque wrench, torque the screws to 40 in-lbs.

8. Connect the following cables to the back of the Controller in the order listed:

E1 120Ω Controller		E1 75Ω Controller	
Connector	**Located on:**	**Connector**	**Located on:**
GND		GND	
10 Mbs	ELP Card	10 Mbs	ELP Card
REDUND	SEP Card	REDUND	SEP Card
GPS ANT	SRI Card	GPS ANT	SRI Card
REDUND	SRI Card	REDUND	SRI Card
OUT 1	SRI Card	OUT 1	SRI Card
OUT 2 (if used)	SRI Card	OUT 2 (if used)	SRI Card
SERIAL	S/P Card	SERIAL	S/P Card
PARALLEL	S/P Card	PARALLEL	S/P Card
NETWORK	E1 120Ω Card	TRANSMIT	E1 75Ω Card
BATTERY		RECEIVE	E1 75Ω Card
		BATTERY	

9. Turn on Controller by setting the respective circuit breakers (CTRL A or CTRL B) on the Circuit Breaker Panel to ON.

iSC E1 75Ω Transient Card Removal/Installation

Removal

Note: Keep track of Controller cabling connections when removing and reconnecting cables. Label each cable that connects to the Controller before removing cable.

1. Remove power from the Controller being removed by setting the respective circuit breaker (CTRL A or CTRL B) on the Circuit Breaker Panel to OFF.
2. Disconnect the cables from the back of the Controller in the order listed:

Connector	Located on:
BATTERY	
RECEIVE	E1 75Ω Card
TRANSMIT	E1 75Ω Card
PARALLEL	S/P Card
SERIAL	S/P Card
OUT 1	SRI Card
OUT 2 (if used)	SRI Card
REDUND	SRI Card
GPS ANT	SRI Card
REDUND	SEP Card
10 Mbs	ELP Card
GND	

3. Remove the four mounting screws from the front panel of the Controller.

4. Using the handle on the front of the Controller, remove the Controller from the Cabinet.

5. Remove the cover from the Controller.

Note: The E1 75Ω Transient Card is located in slot 10 of the Controller and is held in place by one screw.

6. Remove the screw securing the E1 75Ω Transient Card to the Controller chassis.

7. Remove the following E1 75Ω Transient Card cable:

Cable	Part Number	E1 75Ω Transient Card connector
10 pin ribbon	3082057V06	P1

8. Remove the E1 75Ω Transient Card from the Controller chassis.

9. Record the bar code number of the faulty E1 75Ω Transient Card in the site records.

Installation

1. Unpack the new E1 75Ω Transient Card and record the bar code number in the site records.

2. Place the E1 75Ω Transient Card into mounting position in the Controller chassis.

3. Using the E1 75Ω Transient Card mounting screw removed during removal procedure, secure the E1 75Ω Transient Card to the Controller chassis.

4. Connect the following E1 75Ω Transient Card cable:

Cable	Part Number	E1 75Ω Transient Card connector
10 pin ribbon	3082057V06	P1

5. Snap the cover back on the Controller chassis.

6. Place the Controller in the Cabinet.

7. Using the four Controller mounting screws removed during removal procedure, secure the Controller to the front of the Cabinet.

   Using a torque wrench, torque the screws to 40 in-lbs.

8. Connect the following cables to the back of the Controller in the order listed:

E1 75Ω Controller	
Connector	**Located on:**
GND	
10 Mbs	ELP Card
REDUND	SEP Card
GPS ANT	SRI Card
REDUND	SRI Card
OUT 1	SRI Card
OUT 2 (if used)	SRI Card
SERIAL	S/P Card
PARALLEL	S/P Card
TRANSMIT	E1 75Ω Card
RECEIVE	E1 75Ω Card
BATTERY	

9. Turn on Controller by setting the respective circuit breakers (CTRL A or CTRL B) on the Circuit Breaker Panel to ON.

iSC E1 120Ω Transient Card Removal/Installation

Removal

Note: Keep track of Controller cabling connections when removing and reconnecting cables. Label each cable that connects to the Controller before removing cable.

1. Remove power from the Controller being removed by setting the respective circuit breaker (CTRL A or CTRL B) on the Circuit Breaker Panel to OFF.

2. Disconnect the cables from the back of the Controller in the order listed:

Connector	Located on:
BATTERY	
NETWORK	E1 120Ω Card
PARALLEL	S/P Card
SERIAL	S/P Card
OUT 1	SRI Card
OUT 2 (if used)	SRI Card
REDUND	SRI Card
GPS ANT	SRI Card
REDUND	SEP Card
10 Mbs	ELP Card
GND	

3. Remove the four mounting screws from the front panel of the Controller.

4. Using the handle on the front of the Controller, remove the Controller from the Cabinet.

5. Remove the cover from the Controller.

Note: The E1 120Ω Transient Card is located in slot 10 of the Controller and is held in place by one screw.

6. Remove the screw securing the E1 120Ω Transient Card to the Controller chassis.

7. Remove the following E1 120Ω Transient Card cable:

Cable	Part Number	E1 120Ω Transient Card connector
10 pin ribbon	3082057V06	P1

8. Remove the E1 120Ω Transient Card from the Controller chassis.

9. Record the bar code number of the faulty E1 120Ω Transient Card in the site records.

Installation

1. Unpack the new E1 120Ω Transient Card and record the bar code number in the site records.

2. Place the E1 120Ω Transient Card into mounting position in the Controller chassis.

3. Using the E1 120Ω Transient Card mounting screw removed during removal procedure, secure the E1 120Ω Transient Card to the Controller chassis.

4. Connect the following E1 120Ω Transient Card cable:

Cable	Part Number	E1 120Ω Transient Card connector
10 pin ribbon	3082057V06	P1

5. Snap the cover back on the Controller chassis.

6. Place the Controller in the Cabinet.

7. Using the four Controller mounting screws removed during removal procedure, secure the Controller to the front of the Cabinet.

Using a torque wrench, torque the screws to 40 in-lbs.

8. Connect the following cables to the back of the Controller in the order listed:

E1 120Ω Controller	
Connector	**Located on:**
GND	
10 Mbs	ELP Card
REDUND	SEP Card
GPS ANT	SRI Card
REDUND	SRI Card
OUT 1	SRI Card
OUT 2 (if used)	SRI Card
SERIAL	S/P Card
PARALLEL	S/P Card
NETWORK	E1 120Ω Card
BATTERY	

9. Turn on Controller by setting the respective circuit breakers (CTRL A or CTRL B) on the Circuit Breaker Panel to ON.

iSC Front Panel Display Card Removal/Installation

Removal

Note: Keep track of Controller cabling connections when removing and reconnecting cables. Label each cable that connects to the Controller before removing cable.

1. Remove power from the Controller being removed by setting the respective circuit breaker (CTRL A or CTRL B) on the Circuit Breaker Panel to OFF.

2. Disconnect the cables from the back of the Controller in the order listed:

T1 Controller		E1 120Ω Controller		E1 75Ω Controller	
Connector	**Located on:**	**Connector**	**Located on:**	**Connector**	**Located on:**
BATTERY		BATTERY		BATTERY	
T1 NETWORK	T1 Card	NETWORK	E1 120Ω Card	RECEIVE	E1 75Ω Card
PARALLEL	S/P Card	PARALLEL	S/P Card	TRANSMIT	E1 75Ω Card
SERIAL	S/P Card	SERIAL	S/P Card	PARALLEL	S/P Card
OUT 1	SRI Card	OUT 1	SRI Card	SERIAL	S/P Card
OUT 2 (if used)	SRI Card	OUT 2 (if used)	SRI Card	OUT 1	SRI Card
REDUND	SRI Card	REDUND	SRI Card	OUT 2 (if used)	SRI Card
GPS ANT	SRI Card	GPS ANT	SRI Card	REDUND	SRI Card
REDUND	STP Card	REDUND	STP Card	GPS ANT	SRI Card
10 Mbs	ELP Card	10 Mbs	ELP Card	REDUND	STP Card
GND		GND		10 Mbs	ELP Card
				GND	

3. Remove the four mounting screws from the front panel of the Controller.

4. Using the handle on the front of the Controller, remove the Controller from the Cabinet.

5. Remove the cover from the Controller.

6. Remove six screws securing the Front Panel to chassis.

Note: The Front Panel Display Card is located at the bottom of the Controller and is held in place by one screw.

7. Disconnect the following Front Panel Display Card cables:

Cable	Part Number	Front Panel Display Card connector
10 pin ribbon	3082057V06	P3
26 pin ribbon	3085427U04	P4
20 pin ribbon	3083414X01	P2
4 pin ribbon	3085431U04	P5
10 pin ribbon	3082057V06	P1

8. Remove the screw securing the Front Panel Display Card to the Controller chassis.

9. Remove the Front Panel Display Card from the Controller chassis by removing it from the snap-top standoffs.

10. Record the bar code number of the faulty Front Panel Display Card in the site records.

Installation

1. Unpack the new Front Panel Display Card and record the bar code number in the site records.

2. Align and mate the Front Panel Display Card onto the snap-top standoffs in the Controller chassis.

3. Using the Front Panel Display Card mounting screw removed during removal procedure, secure the Front Panel Display Card to the Controller chassis.

4. Connect the following Front Panel Display Card cables:

Cable	Part Number	Front Panel Display Card connector
10 pin ribbon	3082057V06	P1
4 pin ribbon	3085431U04	P5
20 pin ribbon	3083414X01	P2
26 pin ribbon	3085427U04	P4
10 pin ribbon	3082057V06	P3

5. Secure the Front Panel using the six Front Panel mounting screws removed during removal procedure.

6. Snap the cover back on the Controller chassis.

7. Place the Controller in the Cabinet.

8. Using the four Controller mounting screws removed during removal procedure, secure the Controller to the front of the Cabinet.

   Using a torque wrench, torque the screws to 40 in-lbs.

9. Connect the following cables to the back of the Controller in the order listed:

T1 Controller		E1 120Ω Controller		E1 75Ω Controller	
Connector	Located on:	Connector	Located on:	Connector	Located on:
GND		GND		GND	
10 Mbs	ELP Card	10 Mbs	ELP Card	10 Mbs	ELP Card
REDUND	STP Card	REDUND	SEP Card	REDUND	SEP Card
GPS ANT	SRI Card	GPS ANT	SRI Card	GPS ANT	SRI Card
REDUND	SRI Card	REDUND	SRI Card	REDUND	SRI Card
OUT 1	SRI Card	OUT 1	SRI Card	OUT 1	SRI Card
OUT 2 (if used)	SRI Card	OUT 2 (if used)	SRI Card	OUT 2 (if used)	SRI Card

T1 Controller		E1 120Ω Controller		E1 75Ω Controller	
Connector	**Located on:**	**Connector**	**Located on:**	**Connector**	**Located on:**
SERIAL	S/P Card	SERIAL	S/P Card	SERIAL	S/P Card
PARALLEL	S/P Card	PARALLEL	S/P Card	PARALLEL	S/P Card
T1 NETWORK	T1 Card	NETWORK	E1 120Ω Card	TRANSMIT	E1 75Ω Card
BATTERY		BATTERY		RECEIVE	E1 75Ω Card
				BATTERY	

10. Turn on Controller by setting the respective circuit breakers (CTRL A or CTRL B) on the Circuit Breaker Panel to ON.

iSC Front Panel Display Card Removal/Installation

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Appendix A

Acronyms

Acronym	Definition
A/D	Analog-to-Digital
A	Amperes
AC	Alternating Current
ACG	Access Controller Gateway
ACT	Active
ADA	American Disabilities Act
AIC	Ampere Interrupting Capacity
AIS	Alarm Indication Signal (Keep Alive)
AMI	Alternate Mark Inversion
ANSI	American National Standards Institute
ASCII	American National Standard Code for Information Interchange
ASIC	Application Specific Integrated Circuit
Aux	Auxiliary
avg	average
AWG	American Wire Gauge
bd	baud
BERT	Bit Error Rate Test
BMR	Base Monitor Radio
BNC	Bayonet “N” Connector
BPV	Bipolar Violation
BR	Base Radio
BRC	Base Radio Controller
BSC	Base Site Controller
BTU	British Thermal Unit
B8ZS	Bipolar with 8-Zero Substitution
CC	Control Cabinet
CD	Carrier Detect
cd	change directory
CLK	Clock
CLT	Controller
cm	centimeter
CMOS	Complementary Metal Oxide Semiconductor
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
CSMA/CD	Carrier Sense Multiple Access with Collision Detect
CSU	Channel Service Unit
CTS	Clear to Send
D/A	Digital-to-Analog
DAP	Dispatch Application Processor
DB-15	15-pin D-subminiature
DB-9	9-pin D-subminiature
DC	Direct Current

Acronym	Definition
DCE	Data Circuit-Terminating Equipment
DCSPLY	DC Supply
deg	degree
DIP	Dual In-line Package
div	division
DMA	Direct Memory Access
DOP	Dilution of Precision
DRAM	Dynamic Random Access Memory
DS0	64Kb Data Channel
DS1	1.544Mb Data Channel
DSP	Digital Signal Processor
DTE	Data Terminal Equipment
DVM	Digital Volt Meter
E1	2.048 Mb telephone line
E-NET	Ethernet
EAS	Environmental Alarm System
EBTS	Enhanced Base Transceiver System
EIA	Electronics Industry Association
ELP	Ethernet LAN PCI card
EMI	Electro-Magnetic Interference
EPROM	Erasable Programmable Read Only Memory
EEPROM	Electronically Erasable Programmable Read Only Memory
ESF	Extended Superframe
ESI	Ethernet Serial Interface
ESMR	Enhanced Special Mobile Radio

Acronym	Definition
FCC	Federal Communications Commission
FDL	Facility Data Link
FIFO	First-In, First-Out
FNE	Fixed Network Equipment
freq	frequency
FRU	Field Replaceable Unit
GND	Ground
GPS	Global Positioning System
GPSR	Global Positioning System Receiver
HDB3	High-Density Bipolar of Order 3
HDLC	High-level Data Link
HSO	High Stability Oscillator
HVAC	Heating Ventilation Air Conditioning
Hz	Hertz
I/O	Input/Output
IC	Integrated Circuit
iDEN	integrated Dispatch Enhanced Network
IEEE	Institute of Electrical and Electronic Engineers
iMU	iDEN Monitor Unit
in	inches
ISA	Industry Standard Architecture
iSC	integrated Site Controller
kg	kilogram
kHz	kiloHertz
LAN	Local Area Network

Acronym	Definition
LAPD	Link Access Procedure D-Channel
lbs	pounds
LED	Light Emitting Diode
LIU	Line Interface Unit
LLC	Link Layer Controller
LNA	Low Noise Amplifier
LOS	Loss of Signal
max	maximum
MGN	Multi-Grounded Neutral
MHz	MegaHertz
min	minimum
min	minute
mm	millimeter
MMI	Man-Machine-Interface
MPS	Metro Packet Switch
MS	Mobile Station
MSO	Mobile Switching Office
ms	millisecond
MSC	Mobile Switching Center
N.C.	Normally Closed
N.O.	Normally Open
NEC	National Electric Code
no.	number
NTWK	Network
OEM	Original Equipment Manufacturer
OMC	Operations and Maintenance Center
OSHA	Occupational Safety and Health Act

Acronym	Definition
P/N	Part Number
PA	Power Amplifier
PAL	Programmable Array Logic
PC	Personal Computer
PCI	Peripheral Component Interconnect
PCCH	Primary Control Channel
PDOP	Position Dilution of Precision
PLL	Phase Locked Loop
PPM	Parts Per Million
PPS	Pulse Per Second
PS	Power Supply
PSTN	Public Switched Telephone Network
PSU	Power Supply Unit
PVC	Polyvinyl Chloride
pwr	power
QRSS	Quasi Random Signal Sequence
Qty	Quantity
R1	Receiver #1
R2	Receiver #2
R3	Receiver #3
RAM	Random Access Memory
RCV	Receiver
Ref	Reference
RF	Radio Frequency
RFC	Radio Frequency Cabinet
RFDS	RF Distribution System
RFS	RF System

Acronym	Definition
ROM	Read Only Memory
RPM	Revolutions Per Minute
RU	Rack Unit
Rx	Receive
S/W	Software
sec	second
SF	Superframe
SNMP	Simple Network Manangement Protocol
SQE	Signal Quality Error
SRAM	Static Random Access Memory
SRI	Site Reference ISA card
SRRC	Single Rack Redundant Controller
SRSC	Single Rack Single Controller
SS	Surge Suppressor
STAT	Status
Std	Standard
STP	Subrated T1 PCI card
T1	1.544 Mb telephone line
TDM	Time Division Multiplex
TDMA	Time Division Multiple Access
Telco	Telephone Company
Tx	Transmit
TXD	Transmit Data
typ	Typical
UL	Underwriters Laboratories
V	Voltage

Acronym	Definition
Vac	Voltage - alternating current
Vdc	Voltage - direct current
Vp-p	Voltage peak-to-peak
WDT	Watchdog Timer
WP	Write Protect

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Appendix B

Parts & Suppliers

Overview

This appendix contains recommended part numbers and manufacturers for various hardware, tools, and equipment used during installation of the system.

Also contained in this appendix is other installation-related information, such as determining types of wire lugs, lengths and sizes of various wires and cables, custom cabling information, and fuses.

Note: All suppliers and model numbers listed are recommended due to their proven performance record in previous installations. Motorola cannot guarantee the effectiveness of the installation or performance of the system when using other supplier parts. Addresses, phone numbers, fax numbers, and other information is presented for each of the recommended suppliers, when possible. This information is subject to change without notice.

The following table describes the contents of this appendix.

Surge arrestors

Two types of surge arrestors should be used in the system site, including:

- AC power and Telco
- Antenna surge arrestors

AC power and Telco surge arrestors

The recommended AC Power and Telco surge arrestors are manufactured by Northern Technologies. The model numbers are:

- AC power - *MMK-B1-SSMOT* for 120/240 single-phase
  MMK-C1-SSMOT for 208 Vac three-phase
- Telco - *TCS T1DS*

Northern Technologies

P.O. Box 610
Liberty Lake, WA 99019
Phone: 800-727-9119
Fax: 509-927-0435
Internet: http://www.northern-tech.com/

Antenna surge arrestors

The recommended antenna surge arrestors are manufactured by Polyphaser Inc. The following models are recommended:

- BMR antennas - *ISS50NXXC2MA*
- Base Radio antenna (800 MHz tower top amplifier only) - *094-0801T-A*

- Base Radio antenna (800 MHz cavity combined, transmit only; up to 5 channels) - *IS-CT50HN-MA*
- Base Radio antennas (800 MHz duplexed) - *IS-CT50HN-MA*
- Base Radio antennas (900 MHz duplexed) - 097-0311G-A.2
- GPS antennas - *092-082-0T-A*
- lightning arrestor bracket kit - *Contact your local Motorola sales representative to order this kit*
- receive tower top amplifier - *094-0801T-A*
- tower top test port cable - *IS-50NX-C2*

Polyphaser, Inc.

P.O. Box 9000
Minden, NV 89423-9000
Phone: 800-325-7170
702-782-2511
Fax: 702-782-4476
Internet: www.polyphaser.com

Motorola has set up several kits that contain the necessary arrestors with proper mounting hardware for the various antenna configurations. Contact your local Motorola representative for these OEM kits.

RF attenuators

Several RF attenuators are needed at a site to ensure proper receive adjustments. The attenuators are used at the LNA sites to offset the excess gain from the Tower Top amplifiers, to balance the receive path, and to attenuate the BMR signal path. Use the following specifications when choosing vendors:

- 1 dB increments
- 0.5 dB accuracy or better
- female N connector / male N connector
- Specified frequency range
  - **800 MHz systems** – requires attenuator specification to include 806-821 MHz range
  - **900 MHz systems** – requires attenuator specification to include 896-901 MHz range

Alan Industries, Inc.

745 Green Way Drive
P.O. Box 1203
Columbus, IN 47202
Phone: 800-423-5190
812-372-8869
Fax: 812-372-5909

Huber + Suhner, Inc.

19 Thompson Drive
Essex, VT 05451
Phone: 802-878-0555
Fax: 802-878-9880
Internet: www.hubersuhnerinc.com

JFW Industries, Inc.

5134 Commerce Square Drive
Indianapolis, IN 46237
Phone: 317-887-1340
Fax: 317-881-6790
email: JFW atten@aol.com

Pasternack Enterprises

P.O. Box 16759
Irvine, CA 92713
Phone: 714-261-1920
Fax: 714-261-7451

Emergency generator

Several different generator sizes are available. Determine the loading requirements of the site prior to ordering a generator. A recommended manufacturer of the emergency backup generator power system is:

Generac Corporation

P.O. Box 8
Waukesha, WI 53187
Phone: 414-544-4811
Fax: 414-544-0770

Portable generator connection

The recommended portable generator connection is the *AJA200-34200RS*, manufactured by Appleton Electric. Figure B-1 is a view of a connector located on the building. An adapter may be required if local electrical standards conflict with the wiring configuration.

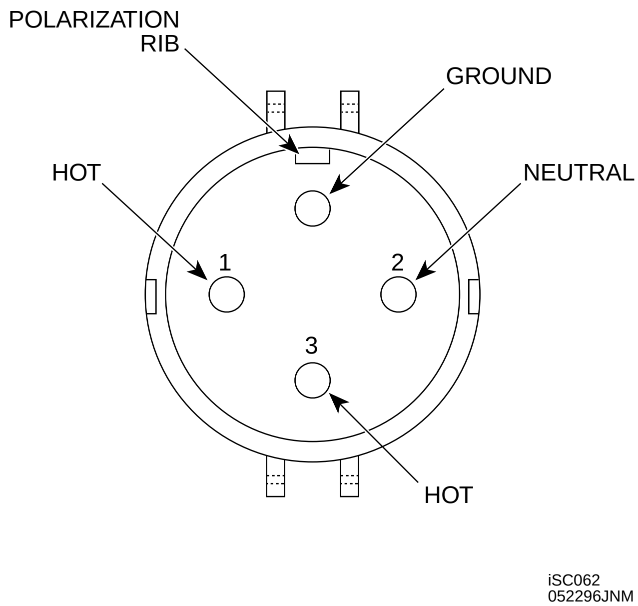

Figure B-1 ***Portable generator connector***

An alternate supplier of the portable generator connection is the *ARKTITE Heavy Duty Receptacle Model 80, Style 2, 200 Amps*, manufactured by Crouse-Hinds.

Crouse-Hinds, Inc.

P.O. Box 4999
Syracuse, NY 13221
Phone: 315 477-7000
Fax: 315 477-5717

GPS evaluation kit

The GPS evaluation kit (part number VPEVL0002) is available from Motorola Position and Navigation System Business.

Motorola Position and Navigation System Business

4000 Commercial Avenue
Northbrook, IL 60062
Phone: 847 714-7329
Fax: 847 714-7325

GPS antenna amplifier

There are two recommended manufacturers of the GPS antenna amplifiers. The model numbers are:

- *LA20RPDC-N* (made by WR, Inc.) (Type 1)
- *GA-12F-N* (made by CTS Co.) (Type 2)

WR, Inc.

1709C Little Orchard Street
San Jose, CA 95125
Phone: 408 294-5746
Fax: 408 294-3845

Starlink Inc.

6400 Highway 290 East
Suite 202
Austin, TX 78723
Phone: 512 454-5511
800 460-2167
Fax: 512 454-5570

Specifications	Type 1	Type 2
Dimensions	3.293” x 2” x 1”	1” dia. x approx. 6”
Connectors	type N female, both ends	type N female, both ends
Gain	23 dB gain typical, 20 dB min.	12 dB ± 2 dB
Noise figure	2.6 dB typical	4.0 dB
VSWR	< 2.2:1	<2:1

Specifications	Type 1	Type 2
Frequency range	1575.42 ± 50 MHz	1575.42 ± 10 MHz
Filtering	yes	yes
Maximum input power	+ 13 dBM	0 dBM
Voltage	4.5 - 15 VDC	4.5 - 15 VDC
Current @ 5 V	< 15 mA typical	< 20 mA

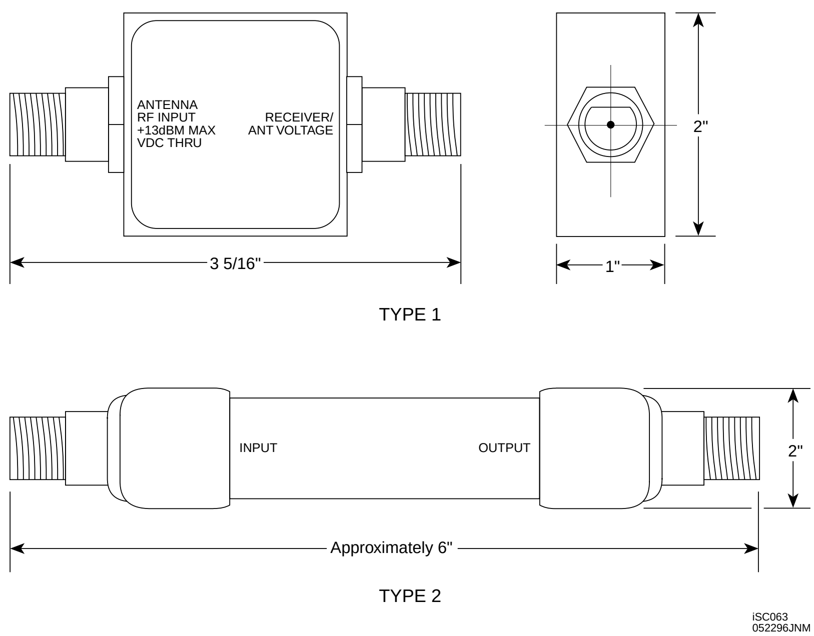

Figure B-2 ***GPS antenna amplifiers***

Site alarms

Three types of alarms should be used at a site, including:

- Intrusion alarm
- Smoke alarm
- Temperature alarm

Intrusion alarm

The recommended intrusion alarm is the *Sonitrol 29A*.

Sonitrol

1800 Diagonal Road #180
Alexandria, VA 22314
Phone: 800 326-7475
Fax: 703 684-6612

Smoke alarm

A recommended smoke alarm is the *Sentrol 320CC*. This smoke alarm provides a relay closure for the iMU alarm. These smoke detectors are available from many electrical wholesale distributors. For the location nearest you, call Sentrol between 6 a.m. and 5 p.m. Pacific Standard Time and ask Sales for the location of the nearest EW (Electric Wholesale) distributor.

Sentrol, Inc.

12345 SW Leveton Drive
Tualatin, OR 97062
Phone: 503-692-4052
Phone: 800 547-2556
Fax: 503-691-7566

Temperature alarm

The recommended temperature alarm is the *Grainger #2E206* thermostat. This alarm is manufactured by Dayton Electronics and distributed by W.W. Grainger:

W.W. Grainger

Locations Nationwide
Phone: 800 323-0620
Fax: 800 722-3291

Site alarm wiring

The following table identifies recommended Motorola part numbers for prewiring the site alarms.

Part number	Description	Quantity
0183652P01	punch block	2
3084966K01	alarm cable	2

Cabinet mounting hardware

The cabinet mounting hardware is site dependent and must be procured locally.

Equipment cabinets

The mounting hardware used to secure the equipment cabinets containing control and/or RF hardware must be able to provide 1545 pounds of retention force.

- If the cabinets are to be secured to a concrete floor, 1/2” grade 8 bolts with anchors are recommended.
- If the cabinets are to be secured to another type of floor, determine the appropriate mounting hardware.

Power Supply Rack

The Motorola offered Power Supply Rack from Power Conversion Products is available in a standard and an earthquake rack.

Power Conversion Products, Inc.

42 East Street
P.O. Box 380
Crystal Lake, IL 60014
Phone: 815 459-9100
Phone: 800 435-4872 (customer service)
Fax: 815 459-9118

If the earthquake rack is used, it must be bolted to the floor using the *02100-13 High Performance Anchor Kit*, consisting of:

- anchors (qty. 4)
- load sharing plates (qty. 2)

- large square washers (qty. 8)

Hendry Telephone Products

P.O.Box 998
Goleta, CA 93116
Phone: 805 968-5511
Fax: 805 968-9561

Cable connections

The recommended manufacturer for all wire lugs used during site installation is Thomas & Betts.

Thomas & Betts

1555 Lynnfield Road
Memphis, TN 38119
Phone: 800 248-7774 (sales/technical support)
Phone: 901 682-7766 (general information)

Note: Double hole wire lugs are preferred, but single hole wire lugs can be used where mounting requirements dictate their use.

Selecting master ground bar lugs

Table B-1 identifies recommended part numbers for wire lugs used to connect chassis ground wiring to the master ground bar from each cabinet.

Table B-1 ***Recommended master ground bar lugs***

Wire size	Wire type	Lug color	Description	P/N †
#2 AWG	stranded	brown	single 1/4” diameter hole	54107
#2 AWG	stranded	brown	double 1/4” diameter hole, 5/8” center	54207
#6 AWG	stranded	blue	single 1/4” diameter hole	54105
#6 AWG	stranded	blue	double 1/4” diameter hole, 5/8” center	54205

NOTE: These lugs require the use of the TBM5-S crimping tool.

† All part numbers are Thomas & Betts.

Selecting cabinet ground lugs

Table B-2 identifies recommended part numbers for wire lugs used to connect chassis ground wiring to the grounding point of each cabinet.

Table B-2 ***Recommended Junction Panel ground lugs***

Wire size	Wire type	Lug color	Description	P/N †
#2 AWG	stranded	brown	single 1/2” diameter hole	54145
#6 AWG	stranded	blue	single 3/8” diameter hole	E6-12

NOTE: These lugs require the use of the TBM5-S crimping tool.

† All part numbers are Thomas & Betts.

Battery system connections

The cable loop length refers to the total length of wire within a given circuit. For example, the combined length of the -48 Vdc (hot) lead and the DC return lead equals the cable loop length. This means that a cabinet that needs 16 feet of wire between the batteries and Power Supply Rack has a total loop length of 32 feet.

Determining battery system wire size

The wire size for the connection between the batteries and the Power Supply Rack is determined by the required wire length and the maximum allowable voltage drop. The voltage drop in the loop must be kept to below 200 mV. The wire selected should be UL-approved and contain a high number of strands for flexibility.

For a standard configuration, the Power Supply Rack is located directly adjacent to the batteries with a cable loop length of 20 feet or less, which requires the use of a 4/0 wire. Table B-3 shows recommended wire sizes for various loop lengths. Larger wire sizes may be used if the recommended sizes are not available. The recommended wire sizes are large enough to allow site expansion to a fully loaded site.

Table B-3 ***Battery system wire size***

Loop length	Wire size
20 feet	4/0 (or 250 MCM)
30 feet	350 MCM
45 feet	500 MCM

Selecting battery system lugs

Depending on the wire size used and the manufacturer of the batteries, different wire lugs are crimped onto the power cable ends. After the wire size has been determined from Table B-3, verify the manufacturer of the Batteries (*Dynasty or Absolyte*).

Two different battery systems are offered with the system. The *Dynasty* system is a low to medium capacity, field expandable system supplied for smaller sites or sites with minimal backup hour requirements. This system is custom designed to Motorola specifications. The *Dynasty* system is manufactured by Johnson Controls:

Johnson Controls

Specialty Battery Division
900 East Keefe Avenue
P.O. Box 591
Milwaukee, WI 53212
Phone: 414 967-6500

The *Absolyte IIP* battery system is a heavy duty, high capacity battery system. The *Absolyte IIP* battery system is manufactured by GNB Technologies:

GNB Technologies

829 Parkview Boulevard
Lombard, IL 60148
Phone: 708 629-5200
Phone: 800 872-0471
Fax: 708 629-2635

Refer to Table B-4 to determine the proper wire lug for the connection of that wire to the Power Supply Rack.

Table B-4 ***Power Supply Rack connection lugs***

Wire size	Cabinet lug	Crimp tool	Lug P/N †
4/0	double 3/8” hole, 1” center	TBM5-S	54212
250 MCM	double 3/8” hole, 1” center	TBM8-S	54213
350 MCM	double 3/8” hole, 1” center	TBM8-S	54215
500 MCM	double 3/8” hole, 1” center	TBM8-S	54218
† All part numbers are Thomas & Betts.			

Refer to Table B-5 to determine the proper wire lug for the connection to the batteries, based on the wire size and battery manufacturer. One column lists the selection for *Dynasty* and the other lists the selection for *Absolyte IIP*.

Table B-5 ***Battery connection lugs***

Wire size	Lug color	Dynasty		Absolyte IIP	
		Description	P/N	Description	P/N
4/0	purple	double 3/8” hole, 1” center	54212	single 1/2” hole	54170
250 MCM	yellow	double 3/8” hole, 1” center	54215	single 1/2” hole	54113
350 MCM	red	double 3/8” hole, 1” center	54218	single 1/2” hole	54115
500 MCM	brown	double 3/8” hole, 1” center	54220	single 5/8” hole	54118

Anti-oxidant greases

Any one of the following anti-oxidant greases are recommended for connections to the positive (+) and negative (-) terminals of the batteries:

- No-Ox
- OxGuard
- Penetrox

Intercabinet cabling

Ethernet and alarm cables connecting to the Junction Panels of each cabinet are supplied with the system. These cables may not be suitable for every site. It may be necessary to locally fabricate cables for a custom fit. Information is provided for both supplied cables and custom cables.

Supplied cables

The cables listed in Table B-6 are supplied with the system. The length of these cables should be sufficient if the considerations outlined in the Pre-Installation chapter were followed.

Table B-6 ***Supplied intercabinet cabling***

Description	Qty.	P/N
120" long, N-type male to N-type male cable	3	0112004B24
108" long, BNC male-to-BNC Male, RG400 cable	2*	0112004Z29
210" long, 8-pin modular plug cable	1*	3084225N42
186" long, PCCH redundancy control cable	1**	3082070X01
phasing harness	1	0182004W04

NOTE: All part numbers are Motorola.

* Per RF Cabinet.

** Per Control Cabinet.

Making custom cables

If custom Ethernet or 5 MHz cables must be locally manufactured, use the part numbers listed in Table B-7 for ordering the required materials.

Table B-7 ***Parts for Ethernet and 5 MHz cables***

Description	Qty.	P/N
connector, BNC male	as required	2884967D01
cable, RG400	as required	3084173E01

NOTE: All part numbers are Motorola.

Table B-8 lists the part numbers for custom alarm cables.

Table B-8 ***Parts for alarm cables***

Description	Qty.	P/N
connector, 8-pin modular	as required	2882349V01
cable, 8-wire	as required	locally procured
NOTE: All part numbers are Motorola.		

Table B-9 lists the part numbers for custom PCCH cables.

Table B-9 ***Parts for extending PCCH redundancy control cables***

Description	Qty.	P/N
186" long, PCCH redundancy control cable	1 per Cabinet	3082070X01
8-pin male Telco to 8-pin male Telco extension cable, length: as needed	as required	locally procured
modular, 8-pin female-to-female adaptor	as required	locally procured
NOTE: Motorola does not guarantee proper operation of system if longer PCCH cable is used. All part numbers are Motorola.		

Equipment cabinet power connections

Selecting power connection lugs

Table B-10 identifies recommended part numbers for lugs used for power connections between the Power Supply Rack and the Control and RF Cabinets. The maximum wire size accepted by the Control and RF Cabinets is 2/0. The Control and RF Cabinets use screw type compression connectors and do not require lugs.

Table B-10 ***Recommended power connection lugs for Power Supply Rack***

Size	Lug color	Description	P/N †
2/0	black	double 3/8” hole, 1” center	54210
#2 AWG	brown	double 1/4” hole, 5/8” center	54207
#4 AWG	gray	double 1/4” hole, 5/8” center	54206
#6 AWG	blue	double 1/4” hole, 5/8” center	54205
† All part numbers are Thomas & Betts.			

Determining power connection wire size

The cable loop length refers to the total length of wire within a given circuit. For example, the combined length of the -48 Vdc (hot) lead and the DC return lead equals the cable loop length. This means that a cabinet which needs 16 feet of wire between the Power Supply Rack and equipment cabinets has a total loop length of 32 feet.

The wire size for the connection between the Power Supply Rack and the equipment cabinets is determined by the required wire length and the maximum allowable voltage drop. The voltage drop in the loop must be kept to below 500 mV. The wire selected should be UL-approved and contain a high number of strands for flexibility. Table B-11 shows the recommended wire sizes for various loop lengths of the RF Cabinet. Table B-12 shows the recommended wire sizes for loop lengths of the Control Cabinet

For a standard configuration, the equipment cabinets are located adjacent to the Power Supply Rack with a cable loop length less than 35'.

Table B-11 ***Power connection wire size***

Loop length	Wire size
25 feet or less	#6 AWG
25 to 40 feet	#4 AWG
40 to 60 feet	#2 AWG
60 to 130 feet	1/0 AWG
NOTE: The wire sizes listed are large enough to allow expansion of an RF Cabinet to five Base Radios.	

Table B-12 ***Power connection wire size for Cabinets***

Loop length	Wire size
150 feet or less	#6 AWG

Each equipment cabinet has a total of four Power Supply Rack connections: two -48 Vdc (hot) and two DC returns. Each equipment cabinet contains two separate power distribution systems. A single hot wire and a single return wire are used for each side of the bus. Two return leads provide redundancy and allow a uniform wire size to be used for all 48 Vdc power distribution system connections.

Other recommended suppliers

The following are the addresses of various suppliers for equipment used during system installation.

Test Equipment

- Fluke 77 Digital Multimeter

Fluke Corporation

P.O. Box 9090
Everett, WA 98206-9090
Phone: 206 347-6100

Service computer

A PC or Macintosh can be used for optimization and field service. The following are the minimum requirements:

- 19,200 bps serial port
- one floppy drive
- communication software, such as Smartcomm II or Procomm Plus

Software

- PKZIP software

PKWare Inc.

9025 N. Deerwood Drive
Brown Deer, WI 53223
Phone: 414 354-8699

- ProComm software

Datastorm Technologies, Inc.

P.O. Box 1471
Columbia, MO 65205
Phone: 314 443-3282 (sales)
Phone: 314 875-0530 (technical support)
Fax: 314 875-0595
BBS: 314 875-0503

Ordering spare parts

Motorola Inc.

Purchase orders can be faxed directly to our Customer Operations Hotline number, 847 576-0977. The iDEN Infrastructure Price Book can be viewed at the web address:

http://AccessSecure.mot.com

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Appendix C

Cabling Diagrams

Overview

Note: Data contained in this appendix pertains only to the standard iSC. Refer to chapter 15 for High Capacity iSC installation and cabling instructions.

This appendix provides cabling information for the iSC using the iSC Junction and Circuit Breaker Panels.

For SRRC cabling diagrams, refer to the SRSC GEN 4 EBTS section of the *EBTS System Manual (6881099E10)*. For SRSC cabling diagrams, refer to the SRSC GEN 4 EBTS section of the *EBTS System Manual (6881099E10)*.

iSC Cabling

iSC cabling refers to the cable connections between the Circuit Breaker Panel, Junction Panel, iMU, Controller A, and Controller B.

Table C-1 identifies and Figure C-1 shows iSC cabling.

Table C-1 ***T1 iSC cabling***

Index number	Part number	From	To	Notes
1	3083609X01	**CTL A EAS/IMU** connector on Circuit Breaker Panel	power connector on Controller A **Battery** connector on iMU	Y-cable that supplies power to Controller A and the iMU
2	3082082X02	**CTL B** connector on Circuit Breaker Panel	power connector on Controller B	supplies power to Controller B
3	3082004X03	**ETHERNET OUT** connector on Junction Panel	T-connector tap on Controller A ELP	
4	3082004X03	**5 MHZ/1PPS OUT 1** connector on Junction Panel	T-connector tap	located between Controller A and Controller B SRI “OUT 1”
5	3083415X02	**GPSA TX A** connector on Junction Panel	**GPS ANT** connector on Controller A SRI	
6	3083415X02	**GPSB TX B** connector on Junction Panel	**GPS ANT** connector on Controller B SRI	
7	3083499X01	**CONTROLLER A – PARALLEL** connector on iMU	**PARALLEL** connector on Controller A S/P	
8	0909907D01	**10 Mb/s** connector on Controller A	–	BNC T-connector
9	5882449V01	–	**T1 NETWORK** connector on Controller A T1	modular T-adapter
10	3084225N28 or 3084225N48	–	**T1 NETWORK** connector on Controller B	
11	3084225N28 or 3084225N48	**SERIAL** connector on Controller A S/P	**CONTROLLER A – SERIAL** connector on iMU	

Table C-1 ***T1 iSC cabling — continued***

Index number	Part number	From	To	Notes
12	3083499X01	**CONTROLLER B – PARALLEL** connector on iMU	**PARALLEL** connector on Controller B S/P	
13	3084225N28 or 3084225N48	**CONTROLLER B – SERIAL** connector on iMU	**SERIAL** connector on Controller B S/P	
14	3084225N24	**REDUND** connector on Controller A SRI	**REDUND** connector on Controller B SRI	
15	3084225N24	**REDUND** connector on Controller A STP	**REDUND** connector on Controller B STP	
16	0112004Z17	T-connector on Controller A ELP	T-connector on Controller B ELP	
17	0112004Z01	**OUT 1** connector on Controller A SRI	T-connector	
18	5883679X01	–	–	BNC T-connector
19	0112004Z01	**OUT 1** connector on Controller B SRI	T-connector	
20	0909907D01	**10 Mb/s** connector on Controller B	–	BNC T-connector
21	0909906D01	–	BNC T-connector	termination for Controller B ELP
22	3012028P31	**BMR Antenna** connector on iMU	**BMR ANT** connector on Junction Panel	
23	3082070X01	**CONTROL** connector on iMU	**STATUS** connector on Circuit Breaker Panel	
24[1]	3082004X03	**5 MHZ/1PPS OUT 2** connector on Junction Panel	T-connector tap	located between Controller A and Controller B SRI OUT 2
25[1]	0112004Z01	**OUT 2** connector on Controller A SRI	T-connector tap	
26[1]	5883679X01	–	–	BNC T-connector
27[1]	0112004Z01	**OUT 2** connector on Controller B SRI	T-connector tap	

[1] Cables factory installed on rack after summer 1998. These cables are necessary for sites with 15 BRs or more. See pages 4-8 through 4-15 for further details about 5MHz/1PPS cabling.

iSC Cabling

T1 ISC CABLING DIAGRAM

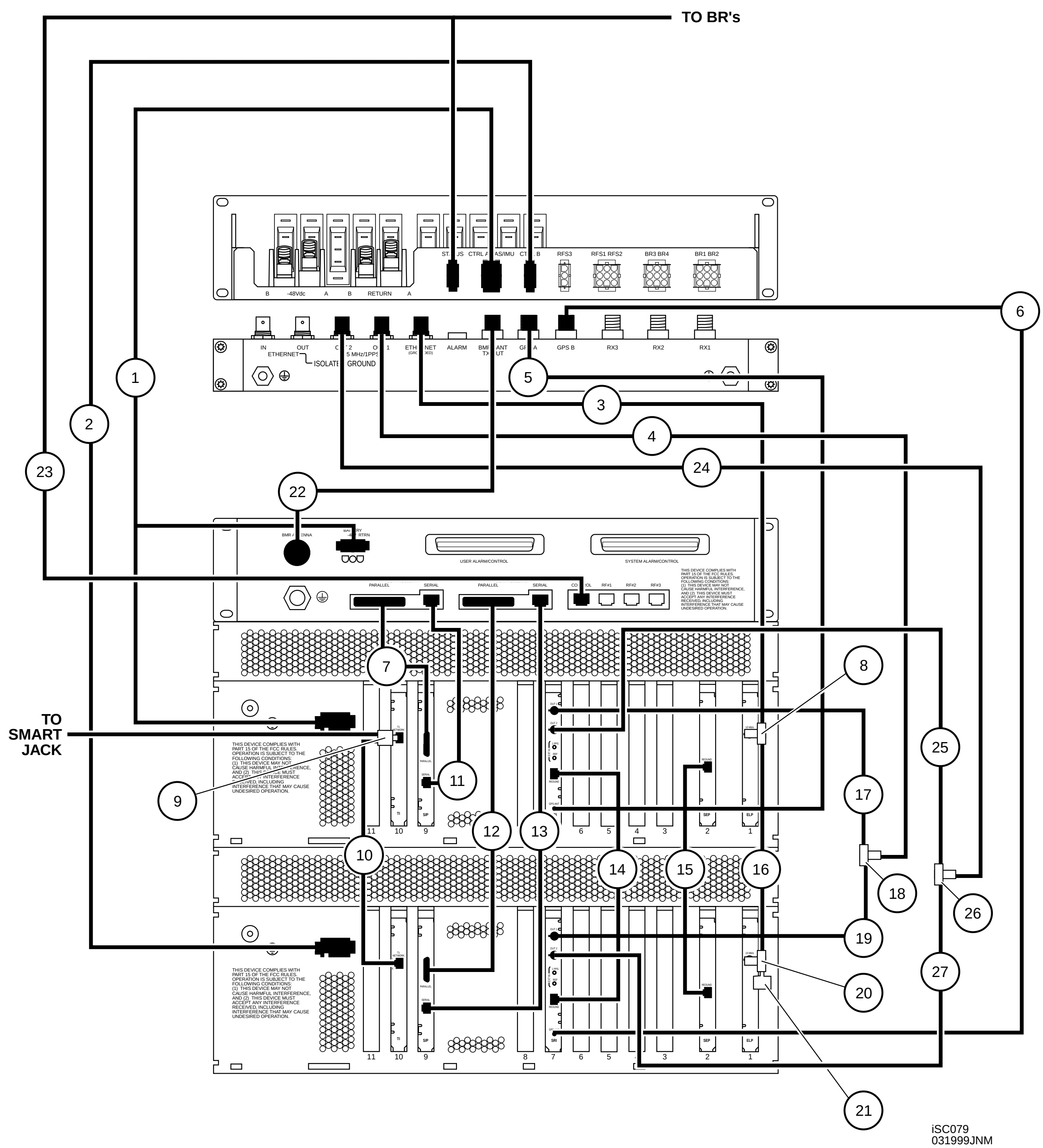

Figure C-1 ***T1 iSC cabling diagram***

Table C-2 identifies and Figure C-2 shows iSC E1 75Ω (2.048 Mb) cabling.

Table C-2 ***iSC E1 75 Ω (2.048 Mb) cabling***

Index number	Part number	From	To	Notes
1	3083609X01	**CTL A EAS/IMU** connector on Circuit Breaker Panel	power connector on Controller A	Y-cable that supplies power to Controller A and the iMU
			Battery connector on iMU	
2	3082082X02	**CTL B** connector on Circuit Breaker Panel	power connector on Controller B	supplies power to Controller B
3	3082004X03	**ETHERNET OUT** connector on Junction Panel	T-connector tap on Controller A ELP	
4	3082004X03	**5 MHZ/1PPS OUT 1** connector on Junction Panel	T-connector tap	located between Controller A and Controller B SRI “OUT 1”
5	3083415X02	**GPSA TX A** connector on Junction Panel	**GPS ANT** connector on Controller A SRI	
6	3083415X02	**GPSB TX B** connector on Junction Panel	**GPS ANT** connector on Controller B SRI	
7	3083499X01	**CONTROLLER A – PARALLEL** connector on iMU	**PARALLEL** connector on Controller A S/P	
8	0909907D01	**10 Mb/s** connector on Controller A	–	BNC T-connector
9	0909907D01	–	–	BNC T-connector
10	3083718X01	**RECEIVE** Connector on Controller A E1	BNC T-Connector	
11	3084225N28 or 3084225N48	**SERIAL** connector on Controller A S/P	**CONTROLLER A – SERIAL** connector on iMU	
12	3083499X01	**CONTROLLER B – PARALLEL** connector on iMU	**PARALLEL** connector on Controller B S/P	
13	3084225N28 or 3084225N48	**CONTROLLER B – SERIAL** connector on iMU	**SERIAL** connector on Controller B S/P	
14	3084225N24	**REDUND** connector on Controller A SRI	**REDUND** connector on Controller B SRI	

iSC Cabling

Table C-2 ***iSC E1 75 Ω (2.048 Mb) cabling — continued***

Index number	Part number	From	To	Notes
15	3084225N24	**REDUND** connector on Controller A SEP	**REDUND** connector on Controller B SEP	
16	0112004Z17	T-connector on Controller A ELP	T-connector on Controller B ELP	
17	0112004Z01	**OUT 1** connector on Controller A SRI	T-connector	
18	5883679X01	–	–	BNC T-connector
19	0112004Z01	**OUT 1** connector on Controller B SRI	T-connector	
20	0909907D01	**10 Mb/s** connector on Controller B	–	BNC T-connector
21	0909906D01	–	BNC T-connector	termination for Controller B ELP
22	3012028P31	**BMR Antenna** connector on iMU	**BMR ANT** connector on Junction Panel	
23	3083718X01	**RECEIVE** connector on Controller B E1	BNC T-connector	
24	3082070X01	**CONTROL** on iMU	**STATUS** connector on circuit Breaker Panel	
25	3083718X01	**TRANSMIT** connector on Controller A E1	BNC T-connector	
26	0909907D01	–	–	BNC T-connector
27	3083718X01	**TRANSMIT** connector on Controller B E1	BNC T-connector	
28[1]	3082004X03	**5 MHZ/1PPS OUT 2** connector on Junction Panel	T-connector tap	located between Controller A and Controller B SRI OUT 2
29[1]	0112004Z01	**OUT 2** connector on Controller A SRI	T-connector tap	
30[1]	5883679X01	–	–	BNC T-connector
31[1]	0112004Z01	**OUT 2** connector on Controller B SRI	T-connector tap	

[1] Cables factory installed on rack after summer 1998. These cables are necessary for sites with 15 BRs or more. See pages 4-8 through 4-15 for further details about 5MHz/1PPS cabling.

75Ω (2.048 Mb) E1 Cabling

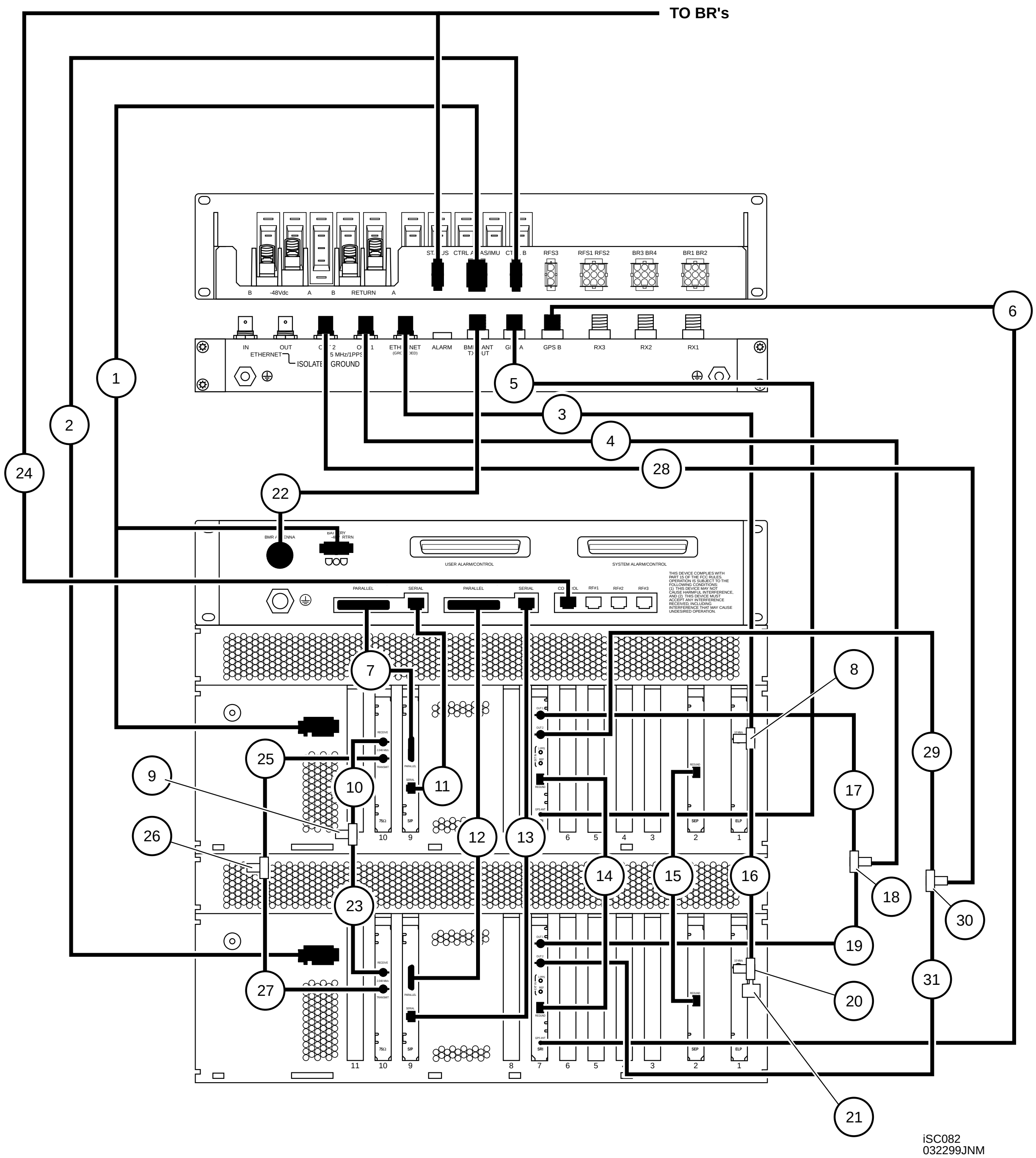

Figure C-2 ***75Ω E1 (2.048 Mb) Cabling***

iSC Cabling

Table C-3 identifies and Figure C-3 shows iSC E1 120Ω (2.048 Mb) cabling.

Table C-3 ***iSC E1 120 Ω (2.048 Mb) cabling***

Index number	Part number	From	To	Notes
1	3083609X01	**CTL A EAS/IMU** connector on Circuit Breaker Panel	power connector on Controller A	Y-cable that supplies power to Controller A and the iMU
			Battery connector on iMU	
2	3082082X02	**CTL B** connector on Circuit Breaker Panel	power connector on Controller B	supplies power to Controller B
3	3082004X03	**ETHERNET OUT** connector on Junction Panel	T-connector tap on Controller A ELP	
4	3082004X03	**5 MHZ/1PPS OUT 1** connector on Junction Panel	T-connector tap	located between Controller A and Controller B SRI "OUT 1"
5	3083415X02	**GPSA TX A** connector on Junction Panel	**GPS ANT** connector on Controller A SRI	
6	3083415X02	**GPSB TX B** connector on Junction Panel	**GPS ANT** connector on Controller B SRI	
7	3083499X01	**CONTROLLER A – PARALLEL** connector on iMU	**PARALLEL** connector on Controller A S/P	
8	0909907D01	**10 Mb/s** connector on Controller A	–	BNC T-connector
9	3082070X01	**CONTROL** connector on iMU	**STATUS** connector on Circuit Breaker Panel	
10	3083721X01	**NETWORK** connector on E1 Controller A	**NETWORK** connector on E1 Controller B	
11	3084225N28 or 3084225N48	**SERIAL** connector on Controller A S/P	**CONTROLLER A – SERIAL** connector on imU	
12	3083499X01	**CONTROLLER B – PARALLEL** connector on iMU	**PARALLEL** connector on Controller B S/P	

Table C-3 ***iSC E1 120 Ω (2.048 Mb) cabling — continued***

Index number	Part number	From	To	Notes
13	3084225N28 or 3084225N48	**CONTROLLER B – SERIAL** connector on iMU	**SERIAL** connector on Controller B S/P	
14	3084225N24	**REDUND** connector on Controller A SRI	**REDUND** connector on Controller B SRI	
15	3084225N24	**REDUND** connector on Controller A SEP	**REDUND** connector on Controller B SEP	
16	0112004Z17	T-connector on Controller A ELP	T-connector on Controller B ELP	
17	0112004Z01	**OUT 1** connector on Controller A SRI	T-connector	
18	5883679X01	–	–	BNC T-connector
19	0112004Z01	**OUT 1** connector on Controller B SRI	T-connector	
20	0909907D01	**10 Mb/s** connector on Controller B	–	BNC T-connector
21	0909906D01	–	BNC T-connector	termination for Controller B ELP
22	3012028P31	**BMR Antenna** connector on iMU	**BMR ANT** connector on Junction Panel	
23[1]	3082004X03	**5 MHZ/1PPS OUT 2** connector on Junction Panel	T-connector tap	located between Controller A and Controller B SRI OUT 2
24[1]	0112004Z01	**OUT 2** connector on Controller A SRI	T-connector tap	
25[1]	5883679X01	–	–	BNC T-connector
26[1]	0112004Z01	**OUT 2** connector on Controller B SRI	T-connector tap	

[1] Cables factory installed on rack after summer 1998. These cables are necessary for sites with 15 BRs or more. See pages 4-8 through 4-15 for further details about 5MHz/1PPS cabling.

iSC Cabling

120Ω (2.048 Mb) E1 Cabling

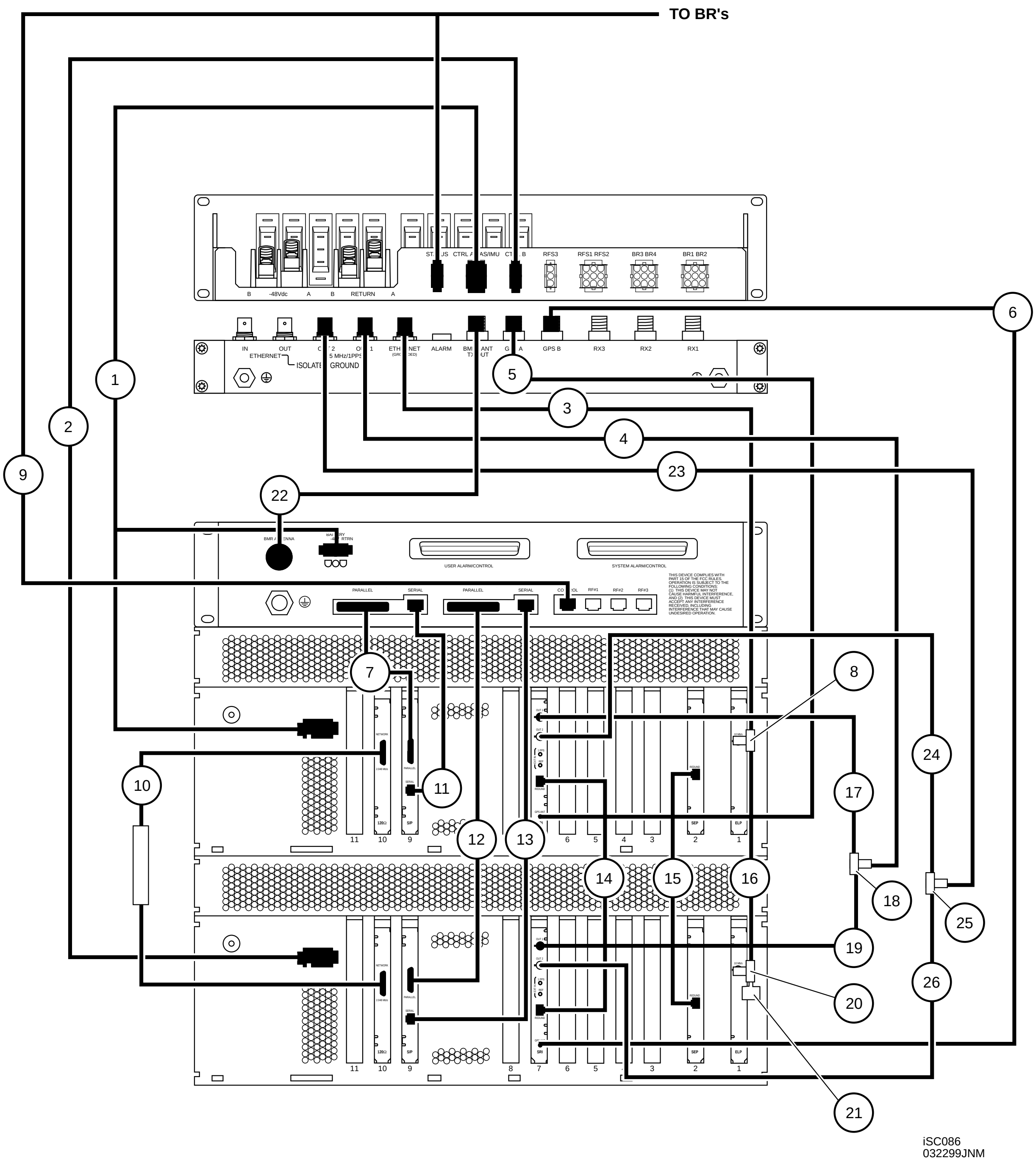

Figure C-3   ***120 Ω (2.048 Mb) E1 Cabling***

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